AN 08-10-256
A. P. No. 2283A

D-30

Handbook of
Maintenance Instructions

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RADIO COMPASSES

TYPES MN-26A, MN-26C, MN-26CA, MN-26M, MN-26W, MN-26X, and MN-26Y

RESTRICTED
(For Official Use Only)

Approved 23 December 1943

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LIST OF REVISED PAGES ISSUED

NOTE: A heavy black vertical line, to the left of the text on revised pages, indicates the extent of the revision. This line is omitted where more than 50 percent of the page is revised.

This issue contains no revisions.

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TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

LIST OF ILLUSTRATIONS

UNSATISFACTORY REPORT

For U. S. Army Air Force Personnel:

In the event of malfunctioning, unsatisfactory design, or unsatisfactory installation of any of the component units of this equipment, or if the material contained in this book is considered inadequate or erroneous, an Unsatisfactory Report, AAF Form No. 54, or a report in similar form, shall be submitted in accordance with the provisions of Army Air Force Regulation No. 15-54, listing:

1. Station and organization.
2. Nameplate data (type number or complete nomenclature if nameplate is not attached to the equipment).
3. Date and nature of failure.
4. Airplane model and serial number.
5. Remedy used or proposed to prevent recurrence.
6. Handbook errors or inadequacies, if applicable.

For U. S. Navy Personnel:

Report of failure of any part of this equipment during its guaranteed life shall be made on Form N. Aer. 4112, "Report of Unsatisfactory or Defective Material," or a report in similar form, and forwarded in accordance with the latest instructions of the Bureau of Aeronautics. In addition to other distribution required, one copy shall be furnished to the inspector of Naval Material (location to be specified) and the Bureau of Ships. Such reports of failure shall include:

1. Reporting activity.
2. Nameplate data.
3. Date placed in service.
4. Part which failed.
5. Nature and cause of failure.
6. Replacement needed (yes—no).
7. Remedy used or proposed to prevent recurrence.

For British Personnel:

Form 1022 procedure shall be used when reporting failure of radio equipment.

DESTRUCTION OF ABANDONED MATERIEL IN THE COMBAT ZONE

In case it should become necessary to prevent the capture of this equipment and when ordered to do so, DESTROY IT SO THAT NO PART OF IT CAN BE SALVAGED, RECOGNIZED, OR USED BY THE ENEMY. BURN ALL PAPERS AND BOOKS.

Means:

1. Explosives, when provided.
2. Hammers, axes, sledges, machetes, or whatever heavy object is readily available.
3. Burning by means of incendiaries such as gasoline, oil, paper, or wood.
4. Grenades and shots from available arms.
5. Burying all debris or disposing of it in streams or other bodies of water, where possible and when time permits.

Procedure:

1. Obliterate all identifying marks. Destroy nameplates and circuit labels.
2. Demolish all panels, castings, switch- and instrument-boards.
3. Destroy all controls, switches, relays, connections, and meters.
4. Rip out all wiring and cut interconnections of electrical equipment. Smash gas, oil, and water-cooling systems in gas-engine generators, etc.
5. Smash every electrical or mechanical part, whether rotating, moving, or fixed.
6. Break up all operating instruments such as keys, phones, microphones, etc.
7. Destroy all classes of carrying cases, straps, containers, etc.
8. Bury or scatter all debris.

DESTROY EVERYTHING!

Figure 1—Type MN-26 Radio Compass Equipment, Components*

SPECIAL NOTICE

Type MN-26★ Radio Compass is a commercial equipment used by the Army Air Forces. Component parts do not bear AN or Signal Corps nomenclature.

SECTION I
GENERAL DESCRIPTION

1. INTRODUCTION.

Type MN-26* Radio Compass models described in this handbook are similar except in frequency range and input voltage.

a. FUNCTION.—The MN-26* radio compass equipment is an aircraft navigational equipment which indicates the direction of any desired transmitting station and also functions as a general radio receiver. The radio compass equipment provides the following services:

(1) Visible indication, by means of a left-right indicator, of the general direction from which the received signal is transmitted.

(2) Radio reception using a non-directional antenna.

(3) Radio reception using a loop antenna while flying through areas of rain and snow static.

(4) Visible indication of relative bearing between the aircraft and the transmitting station by means of an azimuth dial.

b. FREQUENCY.—Radio Compass Type MN-26* operates on three bands. Combinations of various component equipments can be made which will enable frequency ranges from 150 kc to 7.0 mc to be covered.

c. TUNING METHOD.—Tuning is manually controlled from a remote control unit which is mounted within easy reach of the operator. The bands are electrically selected by a control at this remote point.

* Use of this symbol (*) following MN 26 indicates that reference applies to any of the subject equipments, e.g. MN 26A, MN 26C, MN 26CA, etc.

d. POWER REQUIREMENTS.—The equipment is normally supplied to operate from the primary power source indicated in the table below, but may be converted to operate on 14 or 28 volts by simple wiring changes as described in section VI, paragraph 3. The primary input power requirement of Type MN-26* Radio Compass is given below.

Radio Compass Type Number	*Operating Voltage*	*Current Consumption*	
		Normal	*When Selecting Frequency Bands*
MN-26A	14	5.5	8.00
MN-26C	28	3.0	4.25
MN-26CA	28*	3.0	4.25
MN-26M	28	3.0	4.25
MN-26W	14	5.5	8.00
MN-26X	28	3.0	4.25
MN-26Y	28	3.0	4.25

* Type MN-26CA Radio Compass is designed for marine service and the positive input-brush (LV+) is connected to ground in place of the negative input-brush (LV–) as in the other models.

2. EQUIPMENT REQUIRED.

Many arrangements and combinations of Type MN-26* Radio Compasses are possible and no attempt is made in this book to describe them. Fig. 49 shows a typical arrangement, but the actual combination and interconnections will depend upon the installation requirements. The following tables list the installation and component requirements.

COMPONENTS—FUNCTIONS RELATION TABLE

Frequency Range	Input Voltage*	Output Impedance†	Size of Loop	Components Required																	
				MN-26A	*MN-26C or MN-26CA*	*MN-26M*	*MN-26W*	*MN-26X*	*MN-26Y*	*MN-28C*	*MN-28G*	*MN-28NA*	*MN-28X*	*MN-28Y*	*MN-20A or MN-20C‡*	*MN-24A or MN-24B‡*	*IN-4A§*	*MR-57A‖*	*MN-40D or MN-22A*	*MN-52G*	*MR-15A*
150-1500 Kcs	14V	600Ω	9″	X						X					X		X	X	X		X
150-1500 Kcs	14V	600Ω	18″	X						X						X	X	X	X		X
150-1500 Kcs	14V	4000Ω	9″	X							X				X		X	X	X		X
150-1500 Kcs	14V	4000Ω	18″	X							X					X	X	X	X		X
150-1500 Kcs	28V	600Ω	9″		X					X					X		X	X	X		X
150-1500 Kcs	28V	600Ω	18″		X					X						X	X	X	X		X
150-1500 Kcs	28V	4000Ω	9″		X						X				X		X	X	X		X
150-1500 Kcs	28V	4000Ω	18″		X						X					X	X	X	X		X
200-1750 Kcs	14V	600Ω	9″				X						X		X		X	X	X		X
200-1750 Kcs	14V	600Ω	18″				X						X			X	X	X	X		X
200-1750 Kcs	28V	600Ω	9″					X					X		X		X	X	X		X
200-1750 Kcs	28V	600Ω	18″					X					X			X	X	X	X		X
150-695 Kcs and 3.4-7.0 Mcs	28V	600Ω	9″						X					X	X		X	X	X	X	X
150-695 Kcs and 3.4-7.0 Mcs	28V	600Ω	18″						X					X		X	X	X	X	X	X
200-850 Kcs and 3.4-7.0 Mcs	28V	600Ω	9″			X						X			X		X	X	X		X
200-850 Kcs and 3.4-7.0 Mcs	28V	600Ω	18″			X						X				X	X	X	X		X

* May be converted from 14- to 28-volt or from 28- to 14-volt operation by simple wiring changes.
† May be converted with simple wiring changes.
‡ Types MN-20A and MN-24A have right angle (90°) tachshaft fittings, whereas types MN-20C and MN-24B have straight tachshaft fittings.
§ One or two left-right indicators may be used, but when only one is required, the meter load assembly AA18824-1 must be included in the installation.
‖ Use of tuning meter is optional.

COMPONENTS SUPPLIED

Quantity	*Name of Unit*	*Overall Dimensions*	*Weight*
1	Type MN-26* Radio Compass, complete with mounting base and the following:	17-9/16″ x 11-7/32″ x 12″	37 lbs., 6 oz.
1	JAN-6L7		
2	JAN-6N7		
1	JAN-6B8		
2	JAN-6J5		
5	JAN-6K7		
1	JAN-6F6		
1	Antenna plug		
1	Electrical cable plug		
1	Type MN-28* Remote Control complete with mounting base, fuse and electrical cable plug	7-7/16″ x 5¼″ x 3⅝″	2 lbs., 12 oz.
1	Type MN-20A Rotatable Loop Unit, 9″ dia., complete with right-angle (90°) tachshaft fitting or Type MN-20C Rotatable Loop Unit, 9″ dia., complete with straight fitting or Type MN-24A Rotatable Loop Unit, 18″ diameter, complete with right-angle (90°) tachshaft fitting or Type MN-24B Rotatable Loop Unit, 18″ dia., complete with straight tachshaft fitting	10⅝″ x 5½″* x 14-31/32″	5 lbs.
1 or 2	Type IN-4A Left-Right Indicator, complete with electrical cable plug, and meter load assembly AA18824-1	3¼″ x 3¼″ x 3-7/16″	1 lb., 12 oz.
1 (optional)	Type MR-57A Tuning Meter		
1	Type MN-40D Azimuth Indicator or Type MN-22A Azimuth Indicator		
1	Type MR-15A Crank Drive		
1	Mechanical connection from loop to indicator or crank drive AA15410-1		
1	Mechanical connection from crank drive to indicator or loop. (AA15410-1.)		
1	Mechanical connection from compass to remote control unit. (AA15410-1.)		
1	Loop transmission cable from loop to compass AC55966-1 or AC55966-2 or AC55966-3.		

* While the particular compass type number will depend on the frequency range and input voltage desired, the remote control unit must be one which will match the desired compass. The correct remote control type numbers are listed in the following table.

3. ADDITIONAL EQUIPMENT REQUIRED.

The following additional items are required in order to operate this equipment.

COMPONENTS REQUIRED BUT NOT SUPPLIED

Quantity	*Description*
1	14- or 28-volt d-c primary power source.
1	Suitable antenna system (see sec. II, par. 2i).
1 or 2	Headphones (MR-8E, 600-ohm for low-impedance remote control unit; or MR-48A, 4000-ohm for high-impedance remote control unit).

4. DESCRIPTION OF PRINCIPAL COMPONENTS.

a. TYPE MN-26* RADIO COMPASS.—

(1) This radio compass is a manually operated, remotely controlled, 12-tube superheterodyne with an intermediate frequency of 112.5 kilocycles. It includes a cabinet, chassis, and mounting base. All connections are made to the front panel (See Fig. 2). The upper right corner of the front panel contains the gear box which receives the mechanical cable for tuning control at Type MN-28 Remote Control unit. Below the gear box is the "ANTENNA" receptacle and plug for electrical connection to the sense antenna. To the left of the "ANTENNA" receptacle is the "LOOP" receptacle for electrical connection to the type MN-20 or MN-24 rotatable loops. Located to the left of the "LOOP" receptacle is the chassis "RELEASE" control which secures the chassis to the cabinet. To the left of the chassis "RELEASE" control is the receptacle for electrical connection through the junction box to the other components. Three wing-nut Dzus fasteners which provide for easy removal of the radio compass unit also secure the cabinet to the mounting base. The chassis contains the compass circuit elements, the superheterodyne receiver circuit elements, and the high voltage power supply.

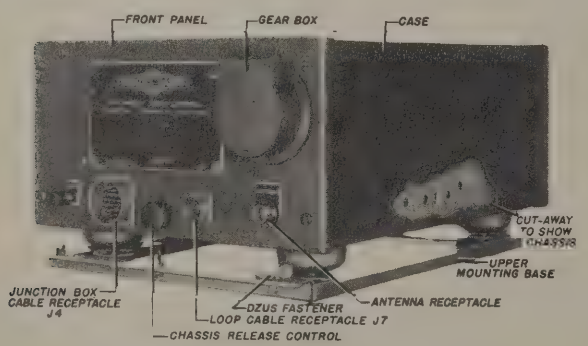

Figure 2—Type MN-26 Radio Compass, Front View*

(2) The frequency range of each of the equipments is covered in three bands as follows:

Type Number	*FREQUENCY RANGE*			*Compass Operation*
	Band I	*Band II*	*Band III*	
MN-26A	150-325 kc	325-695 kc	695-1500 kc	Bands I, II, & III
MN-26C	150-325 kc	325-695 kc	695-1500 kc	Bands I, II, & III
MN-26CA	150-325 kc	325-695 kc	695-1500 kc	Bands I, II, & III
MN-26M	200-410 kc	410-850 kc	3.4-7.0 mc	Bands I, & II
MN-26W	200-410 kc	410-850 kc	850-1750 kc	Bands I, II, & III
MN-26X	200-410 kc	410-850 kc	850-1750 kc	Bands I, II, & III
MN-26Y	150-325 kc	325-695 kc	3.4-7.0 mc	Bands I, & II

(3) Primary power is supplied by the aircraft storage batteries, whereas a dynamotor and filter circuit within the compass supplies the high voltage.

(4) The radio compass is supplied with a complete set of vacuum tubes. The type and function of the complete set of vacuum tubes required are as follows:

VACUUM TUBE DESCRIPTION

Quantity	*Vacuum Tube Type Number*	*Reference No.*	*Function of Vacuum Tube*
5	JAN-6K7	V1	Loop amplifier
		V4	1st r-f amplifier
		V5	2nd r-f amplifier
		V8	I-F amplifier
		V12	Compass amplifier
2	JAN-6N7	V2	Audio oscillator
		V3	Modulator
2	JAN-6J5	V7	Heterodyn oscillator
		V9	CW oscillator
1	JAN-6L7	V6	1st detector
1	JAN-6B8	V10	2nd detector
1	JAN-6F6	V11	Audio amplifier

b. TYPE MN-28 REMOTE CONTROL.—The remote control unit contains all controls for operation of the radio compass equipment. (See Fig. 3.) It contains two "TEL." jacks for connection to the headphones. The dial lighted by Lamp LM-1 indicates the frequency at which the receiver is operating. The controls mounted on the unit (See fig. 3) are as follows:

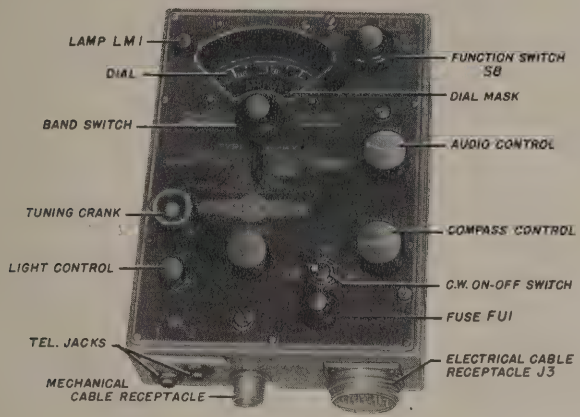

Figure 3—Type MN-28 Remote Control, Front View

(1) TUNING CRANK.—The "TUNING" crank operates the dial and is connected through a train of gears and the mechanical cable to the tuning capacitor of the radio compass unit. The gear ratio between the tuning crank and the variable capacitor is 120 to 1. The dial is calibrated as follows on the different radio compass types:

Type MN-28C and MN-28G

Band I—calibrated every 5 kcs from 150 to 325 kcs.

Band II—calibrated every 10 kcs from 325 to 695 kcs.

Band III—calibrated every 10 kcs from 695 to 1500 kcs.

Type MN-28NA

Band I—calibrated every 5 kcs from 200 to 410 kcs.

Band II—calibrated every 10 kcs from 410 to 850 kcs.

Band III—calibrated every .05 mcs from 3.4 to 7.0 mcs.

Type MN-28X

Band I—calibrated every 5 kcs from 200 to 410 kcs.

Band II—calibrated every 10 kcs from 410 to 850 kcs.

Band III—calibrated every 10 kcs from 850 to 1750 kcs.

Type MN-28Y

Band I—calibrated every 5 kcs from 150 to 325 kcs.

Band II—calibrated every 10 kcs from 325 to 695 kcs.

Band III—calibrated every .05 mcs from 3.4 to 7.0 mcs.

(2) BAND SWITCH.—The frequency-band selector switch, located below the dial, energizes the band switching motor in the radio compass and can select any of the three bands. The mask, attached to the switch shaft, permits viewing only that part of the tuning dial associated with the band selected. The band-range in use is marked on the mask.

(3) FUNCTION SWITCH.—Switch S8, a four-position switch, selects the desired operating function. In the "OFF" position, no current is drawn from the low voltage power supply. In the "COMP." position, the circuit elements are arranged to provide compass operation. In the "REC. ANT." position, the equipment functions as a communication receiver connected to a non-directional vertical antenna. In the "REC. LOOP" position, the equipment functions as a communication receiver connected to the directional loop antenna.

(4) "LIGHT" CONTROL.—This control regulates the brilliancy of Lamp LM-1 which illuminates the calibrated dial.

(5) "AUDIO" CONTROL.—This control regulates the level (volume) of the audio signal in the headsets.

(6) "COMPASS" CONTROL.—This control operates a potentiometer R3 to regulate the extent of pointer deflection of Type IN-4A Left-Right Indicator.

(7) THRESHOLD SENSITIVITY CONTROL.—Control R2 (not shown in fig. 3) is mounted inside the remote control unit case. This control is adjusted at the time of installation (COMP operation only) to limit the gain of the radio frequency amplifiers to such an extent that erratic fluctuations of the left-right indicator due to noise is eliminated. Instructions for adjusting this control are given in section II, paragraph 11.

c. TYPES MN-20 and MN-24 ROTATABLE LOOPS. (See fig. 4.)—The loop permanently fastended into the mounting base, consists of a coil with center tap, enclosed in an electrostatic shield. Connections from the loop coil are made through slip rings to brushes which are connected to the loop transmission cable receptacle. The loop is rotated by means of the associated azimuth control, flexible tuning shaft, and fittings which drive the loop gears that are located in the mounting base.

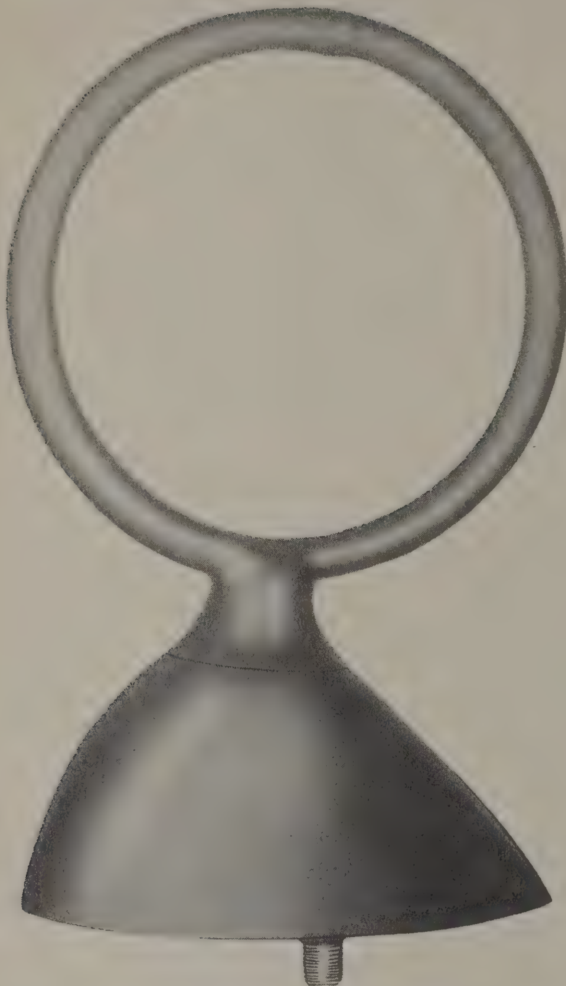

Figure 4—Type MN-20 Rotatable Loop

The following table lists the differences between the types MN-20A, MN-20C, MN-24A, and MN-24B rotatable loops.

Loop Type Number	*Diameter of Loop*	*Type of Fitting*
MN-20A	9″	Right Angle
MN-20C	9″	Straight
MN-24A	18″	Right Angle
MN-24B	18″	Straight

d. TYPE MN-22A AZIMUTH INDICATOR. (See fig. 5.)

(1) This indicator, designed for use with standard tachometer shafts, consists of a double-ended tachshaft drive. This drive is connected through an appropriate gear and cam drive to a pointer that moves in the horizontal plane against the indicator dials. Connected to the internal gearing is a circular cam scribed with 9 circles and 24

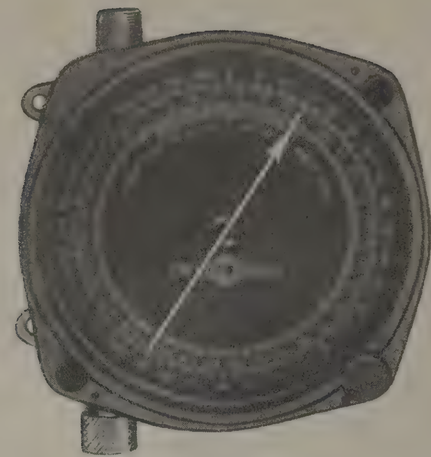

Figure 5—Type MN-224 Azimuth Indicator

radial lines corresponding to degrees correction and degrees azimuth rotation, respectively. The cam may be cut to any required shape to meet the particular installation and can accommodate a maximum error of ±20 degrees. As supplied, the cam introduces no correction and can be used, if no error correction is required without further adjustment. (See sec. II, par. 7, b for shaping cam for error adjustment.) Two instrument lamps provide ample illumination.

(2) Type MN-22A Azimuth Indicator provides means for obtaining loop rotation and bearings (indications of loop settings corrected for quadrantal error) as follows:

(a) Bearings relative to ships heading. (On the outer fixed dial.)

(b) Magnetic bearings. (From the pointer reading on the inner movable dial, after the number on this dial, which corresponds to the airplane's magnetic course, has been set at the zero mark on the fixed dials.)

(c) True bearings. (From the pointer reading on the movable dial after the number on this dial, which corresponds to the airplane's magnetic course, has been set opposite the east or west compass variation shown on the inner fixed dial.)

(d) Reciprocal bearings. (From the opposite end of the pointer.)

e. TYPE MN-40D AZIMUTH INDICATOR. (See fig. 6.)

(1) This indicator consists of a double-ended tuning shaft drive, through a gear- and cam-drive, to a pointer which moves over an azimuth scale. The cam strip, located in the cam housing assembly, is provided with an adjusting screw (through the cam housing assembly) at each 15 degrees around its periphery. This strip controls the compensator which automatically applies the aircraft error cor-

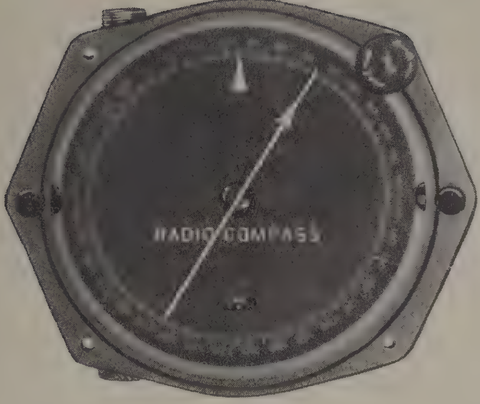

Figure 6—Type MN-40D Azimuth Indicator

rection to the indicator pointer. The scale, visible through the small opening in the lower center of the indicator face, is used as a reference scale when the aircraft error compensators are being adjusted.

(2) The heading of the aircraft relative to magnetic North, and any necessary East or West variation correction is applied by moving the azimuth scale the proper number of degrees relative to the fixed index mark by means of the variation knob.

(3) Quadrantal error correction on this indicator is accomplished by adjusting the cam screws on Type MN-40D Azimuth Indicator. As supplied the cam adjustment screws introduce no correction. Adjustment of the cam is described in Technical Order No. 08-5-29.

f. TYPE IN-4A LEFT-RIGHT INDICATOR. (See fig. 7.)—The left-right indicator shows the general direction of the transmitter and is used for homing. The ON-COURSE mark is a small airplane. The pointer and dial markings are coated with luminous paint.

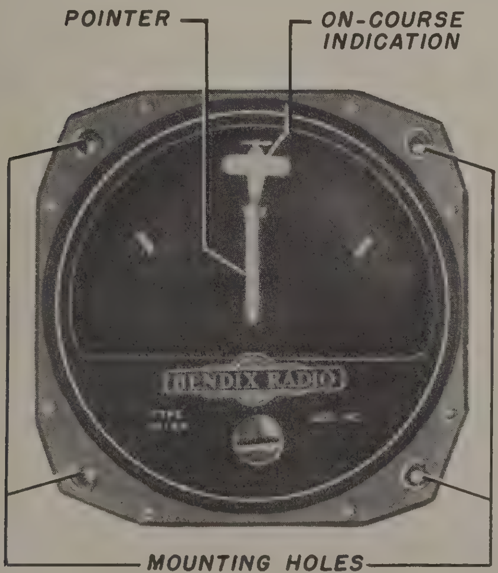

Figure 7—Type IN-4A Left-Right Indicator

g. TYPE MR-15A CRANK DRIVE. (See fig. 8.)—Type MR-15A Crank Drive when coupled by means of the mechanical cable to the azimuth indicator, is used to rotate the indicator and the loop. Couple the cable to either of two pinions depending upon the desired direction of rotation in relationship to loop and indicator rotation. The unused pinion is protected by a cap which is equivalent to the coupling nut of the mechanical cable.

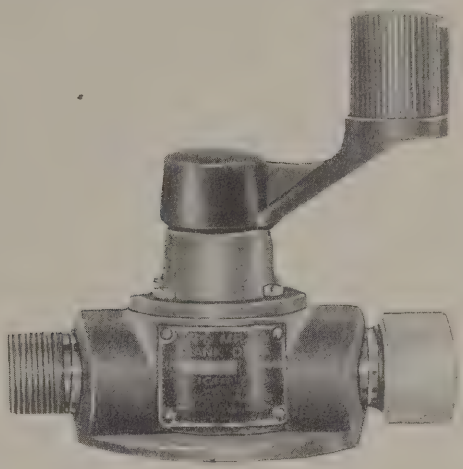

Figure 8—Type MR-15A Crank Drive

h. TYPE MR-57A TUNING METER. (See fig. 9.)—Type MR-57A Tuning Meter is an aircraft type 0-5 milliammeter with a suppressed-zero movement arranged so that the pointer will leave the right hand zero stop with 2 milliamperes and will read full scale at the left stop with 5 milliamperes.

Figure 9—Type MR-57A Tuning Meter

i. MECHANICAL CABLES.—One mechanical cable (Bendix part no. AA15410-1) is required for each of the following mechanical connections:

(1) From Type MN-28 Remote Control to Type MN-26 Radio Compass for tuning (selection of operating frequency).

(2) From Type MR-15A Crank Drive to Type MN-40D Azimuth Indicator or Type MN-22A Azimuth Indicator.

(3) From the indicator to Type MN-20 or MN-24 Rotatable Loop for rotation of the loop.

When ordering mechanical cables, specify the length. Twelve inches is the length of the shortest mechanical cable available. (Fig. 22 illustrates the construction and sec. II, par. 2, describes the alteration of the length.)

SECTION II
INSTALLATION AND ADJUSTMENT

1. PRELIMINARY INSPECTION.

Prior to installation of the components, make a thorough visual and, if possible, an electrical inspection of all components according to the procedure described in section V, paragraph 8.

a. TESTS BEFORE INSTALLATION IN AIRCRAFT.—Considerable time and trouble will be saved if the components of the radio compass equipment, that are to be installed in the aircraft, are interconnected as shown in figure 49, and tested before installation.

(1) If a screen room equipped for compass testing is available, measure the performance of the equipment according to section V, paragraph 8. If the above test setup is not available, properly interconnect the components and test as follows: Tune in several radio stations in each band. On each station operate the equipment on the "COMP.," "REC.-ANT." and "REC.LOOP" positions. When operating the equipment on "COMP.," swing the loop to the right and left and note the degrees of loop rotation required to produce full scale indicator deflection with the "COMPASS" control set at maximum. This should be approximately 5 to 6 degrees, dependent on the input signal strength. Note the on-course and reciprocal bearings. From a knowledge of the distance, power, and direction of the station a rough check may be obtained of the performance of the equipment. Make these tests in a frame test shack in an isolated spot that is free from electrical interference and is at least 2000 feet away from large electrically conductive objects such as buildings, hills, power lines, railroads, etc. **Sensing or bearing accuracy checks can not be relied upon if made inside or close to buildings with metal structures or large electrically conductive objects unless radio compass bearings check actual geographical bearings.** The sensing of the radio compass must be such that the indicator pointer points to the station; that is, if the station is to the left of the perpendicular to the plane of the loop, the indicator will point left; if station is on the right, the indicator will point right.

(2) Make the following inspections prior to installation:

(a) Check list of parts and see that all parts are in good condition.

(b) Insert all tubes in the radio compass unit. Make sure that they are firmly seated in their respective sockets and that all grid clips and grid cap shields are pushed down tightly. The absence of grid cap shields will introduce bearing errors.

(c) Check safety wiring of dynamotor.

(d) Check all lamps and fuses.

(e) Check operation of tuning drives and all controls for freedom of operation.

(f) Allow the equipment to operate for at least one-half hour. Check operation of headset. Vibrate or jar the equipment. Any clicks or increase in noise will require a thorough investigation and removal of the cause. Improper soldering of wires to the plugs and noisy vacuum tubes are the usual source of trouble.

(g) If the equipment does not seem to be operating satisfactorily, recheck the interconnecting leads and vacuum tubes and substitute equipment known to be in operating condition for the faulty component.

b. BONDING AND SHIELDING.—The ultimate sensitivity of any aircraft receiving installation is limited by the magnitude of the local electrical interference, rather than by the actual sensitivity of the receiver as measured in the laboratory. If reception of weak signals is desired, the aircraft, engine, charging generator, ignition system, and all electrical accessories must be completely bonded and shielded as per Army Air Forces Specification No. 32310-B, prior to installation of the equipment.

2. LOCATION AND MOUNTING OF EQUIPMENT.

Necessary dimensions for mounting of the components are described as follows:

a. TYPE MN-26* RADIO COMPASS.—The mounting base of the radio compass must be firmly attached to a plane surface by six #10 screws. Install it so that sufficient clearance is allowed on all sides of the compass for free action of the shock absorbers and for removing the compass from the mounting base. (See fig. 10 for mounting dimensions.)

c. TYPE MN-20 or MN-24 ROTATABLE LOOP.—Mount the loop within a 72- to 168-inch cable run of the compass unit, and as far as possible from antennas and interfering metal structures. The preferred locations are on the fore-and-aft center line of the ship, either above or below the fuselage, about where the wings are attached. Drill the mounting plate for the loop as shown in figures 12 and 13, and

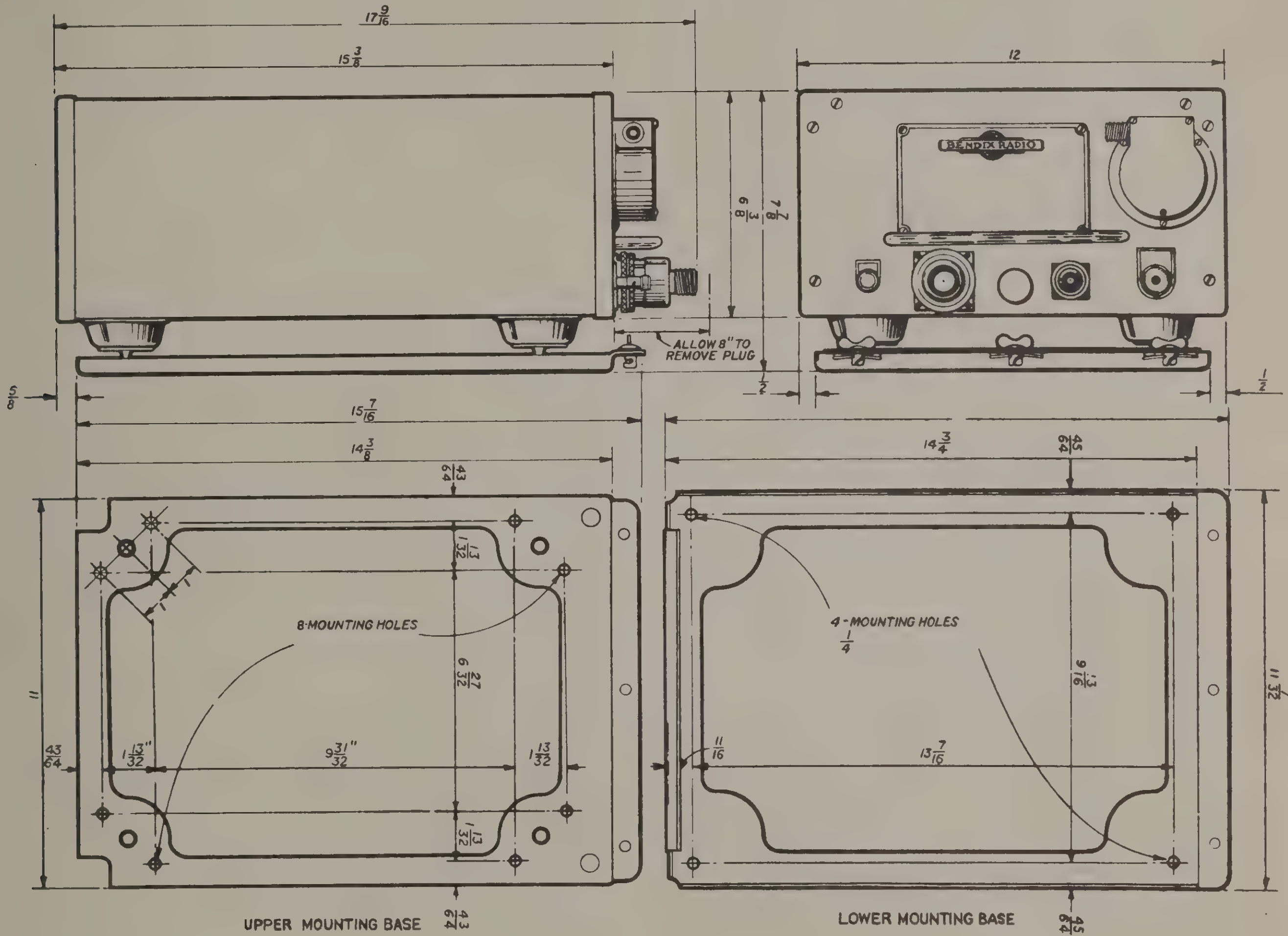

Figure 10—Type MN-26* Radio Compass, Outline and Mounting Dimensions

b. TYPE MN-28 REMOTE CONTROL.—Locate the remote control unit where the panel will be easily visible and the controls accessible to the operator. Consideration must be given to providing clearance for connection of the mechanical and electrical cables. (See fig. 11 for mounting dimensions.)

No mounting holes are provided in the base of the remote control unit since the requirements will vary with individual installations. The control box is secured to its mounting base by means of the three stainless steel fillister-head mounting screws located on the front panel. These are captive-type screws and are loosened to remove the unit from its mounting base.

secure the plate to the aircraft structure so that the loop base will be level during normal flight. Make holes in the skin of the aircraft to permit the passage of the rotator mechanism, the loop transmission cable, and the securing screws. Sufficient clearance must be available inside the fuselage for the attachment and removal of the cables. Use a velutex, or similar gasket between the loop mounting base and the skin of the aircraft to make a water-tight seal.

d. TYPE MN-40D AZIMUTH INDICATOR OR TYPE MN-22A AZIMUTH INDICATOR.—Mount the azimuth indicators so that the dials are easily readable from the operator's position with a minimum of error. Either unit may be used. Figure 14

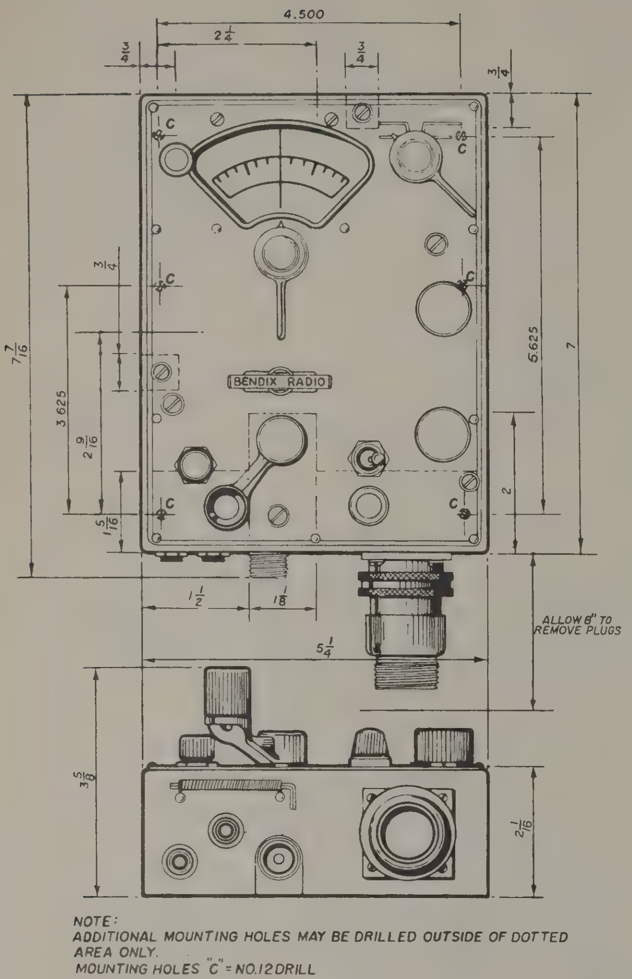

Figure 11—Type MN-28 Remote Control, Outline and Mounting Dimensions

shows mounting dimensions for the Type MN-40D Azimuth Indicator, and figure 15 shows mounting dimensions for the Type MN-22A Azimuth Indicator. Their differences are described in section IV, paragraph 2*e*. To mount the azimuth indicator in a position which will facilitate the approach of the tachshafts and will still retain indications relative to the ships heading, shift the zero positions of the dials to any of four 90-degree separate positions. To change positions remove the snap ring and glass and the eight dial holding screws and then rotate the dial to the desired position. When replacing the screws, use a small amount of glyptal cement to hold them in place. Such a shift in the zero position of the dials will necessitate resetting of the cam of the MN-22A or the cam strip of the MN-40D. Attach the mechanical cable to that azimuth indicator pinion which causes the pointer to rotate in the same direction as the loop. (See fig. 19.) Zero indication on the outer dial of MN-22A must correspond with the zero bearing of the loop.

Two instrument lamps on the indicator have one side grounded and a single wire shielded cable connected to the other side to supply power. Internal dropping resistors permit these 3-volt lamps to also operate from the aircraft 12-volt power source.

e. TYPE IN-4A LEFT-RIGHT INDICATOR.—The left-right indicator is designed to fit standard 3⅓-inch instrument panel mounting holes and space for it is normally available on the instrument panel near the other flight instruments. Clearance must be allowed for the installation of the connecting cable. (Figure 16 shows mounting dimensions.) The left-right indicator need not be shock mounted if the panel on which it is mounted is provided with shock absorbers, otherwise it must be. If only one left-right indicator is used with the installation, connect the field-resonating meter load as shown in figure 39.

f. TYPE MR-15A CRANK DRIVE.—Mount the crank drive where it is convenient to the operator. (See fig. 17 for mounting dimensions.)

g. TYPE MR-57A TUNING METER.—If a tuning meter is used, mount it where visible to the operator. Figure 18 shows the mounting dimensions. If the tuning meter is not used, terminal 18 of receptacle J4 must be grounded.

h. NON-DIRECTIONAL ANTENNA. — Type MN-26* Radio Compass is designed and adjusted to operate in conjunction with a vertical antenna with an effective height of one-half meter, a capacity of 100-micromicrofarads and a resistance between 1 to 10-ohms. The type of antenna which will be used in any particular installation will be dictated by consideration of space and support structures available on the aircraft. On aircraft which will accommodate any one of several types of antenna installations, it is desirable that the type be used which most nearly meets the above requirements and which has the largest ratio of vertical to horizontal length. Vertical rod antennas and T-type wire antennas supported by stub-masts have been found satisfactory. Radio compass antennas are usually kept shorter than the transmitting or receiving antennas to reduce the amount of horizontal antenna effect and the amount of signal pick-up. Place no antenna or lead-in closer than 3 feet from the loop. The portion of the lead-in inside the fuselage must be flexible insulated wire mounted so that the capacitance to ground does not exceed 15 micromicrofarads. If a "spike" antenna is used, the lead-in must be less than two feet long. Keep the lead-in wire as short as possible both on the inside and outside of the aircraft and feed it into the aircraft through a dual-bowl type insulator. Allow some slack at the radio compass to permit free action of the shockmount.

i. CABLES.

(1) Construct the cables with the exception of the loop transmission cable at the time of installation if this is preferable to purchasing complete cables.

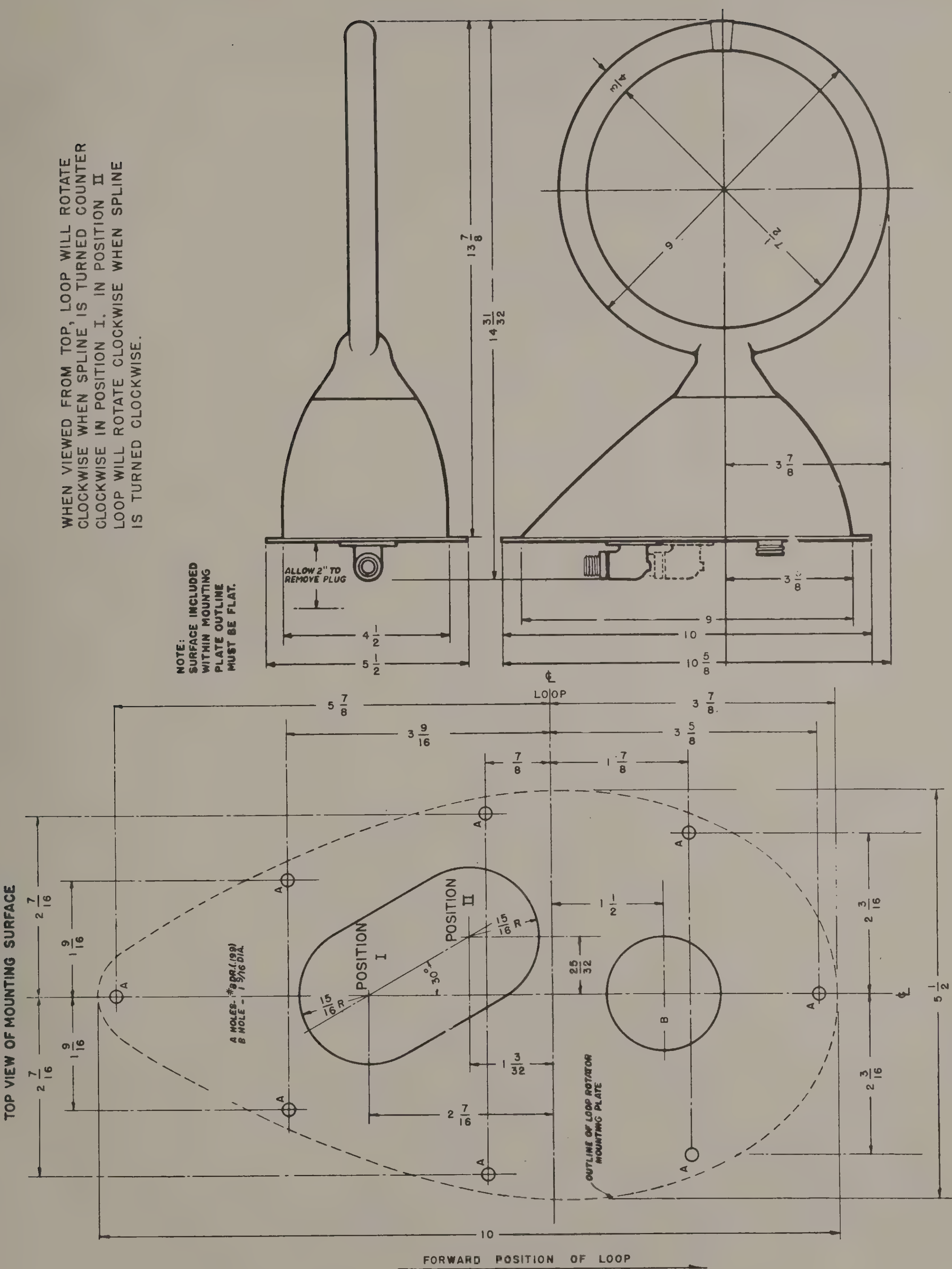

Figure 12—Type MN-20 Rotatable Loop, Outline and Mounting Dimensions

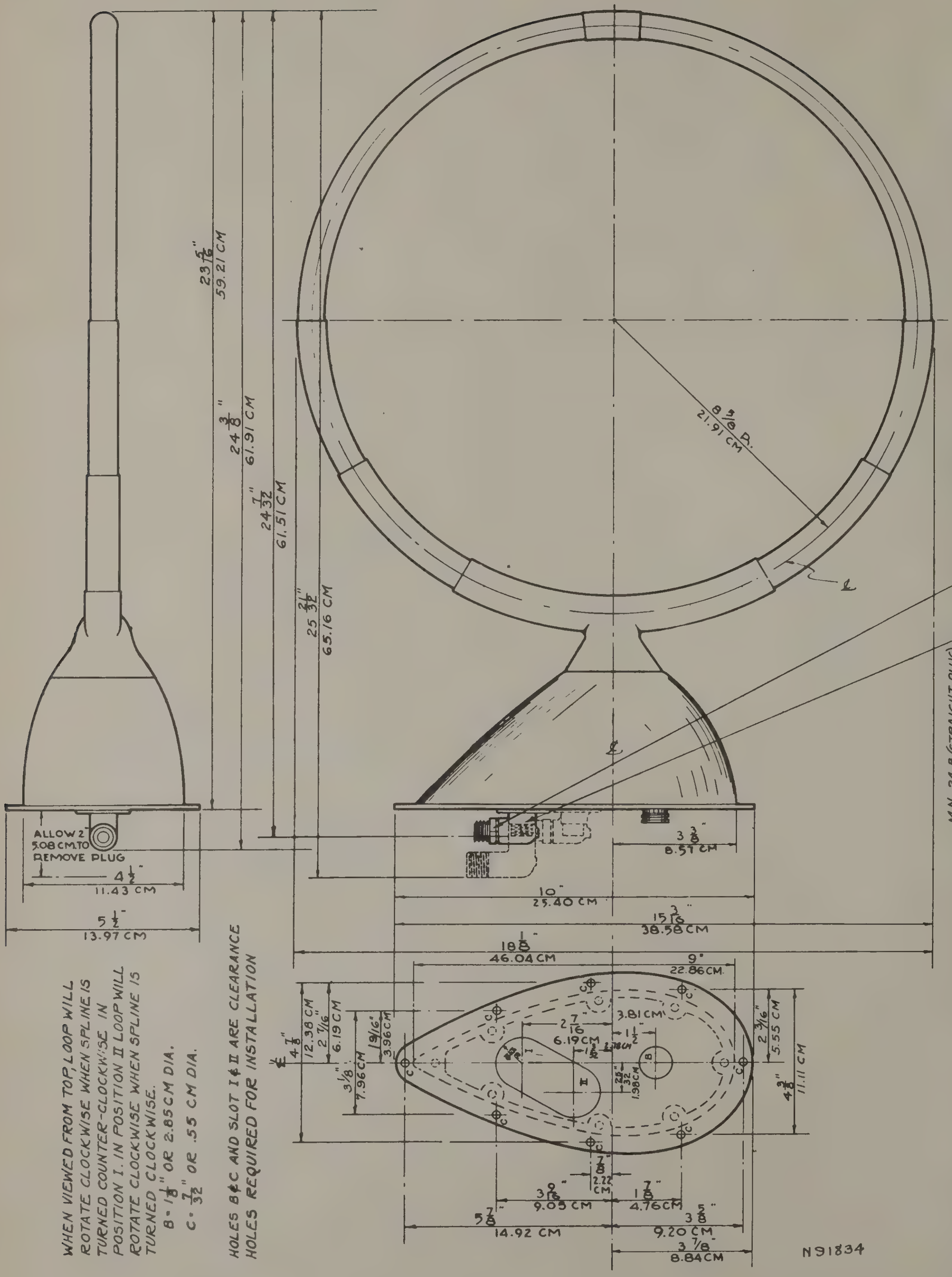

Figure 13—Type MN-24 Rotatable Loop, Outline and Mounting Dimensions

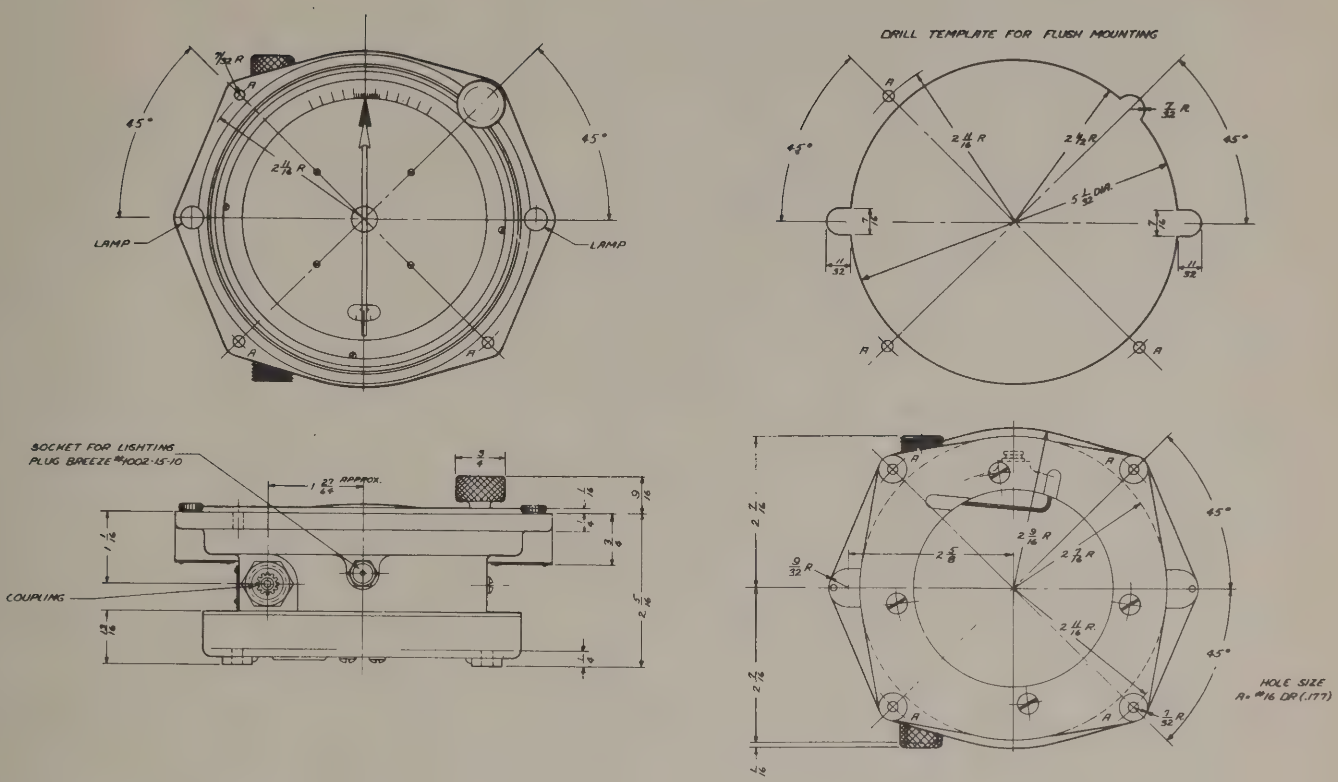

Figure 14—Type MN-40D Azimuth Indicator, Outline and Mounting Dimensions

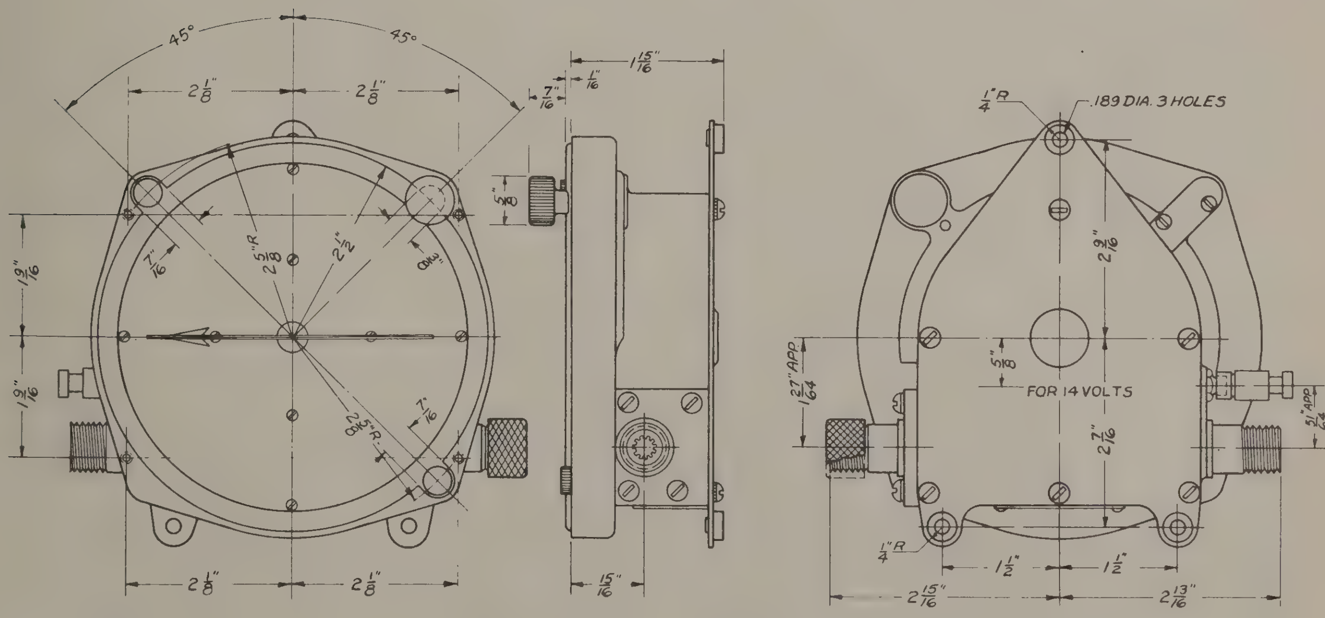

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Figure 15—Type MN-22A Azimuth Indicator, Outline and Mounting Dimensions

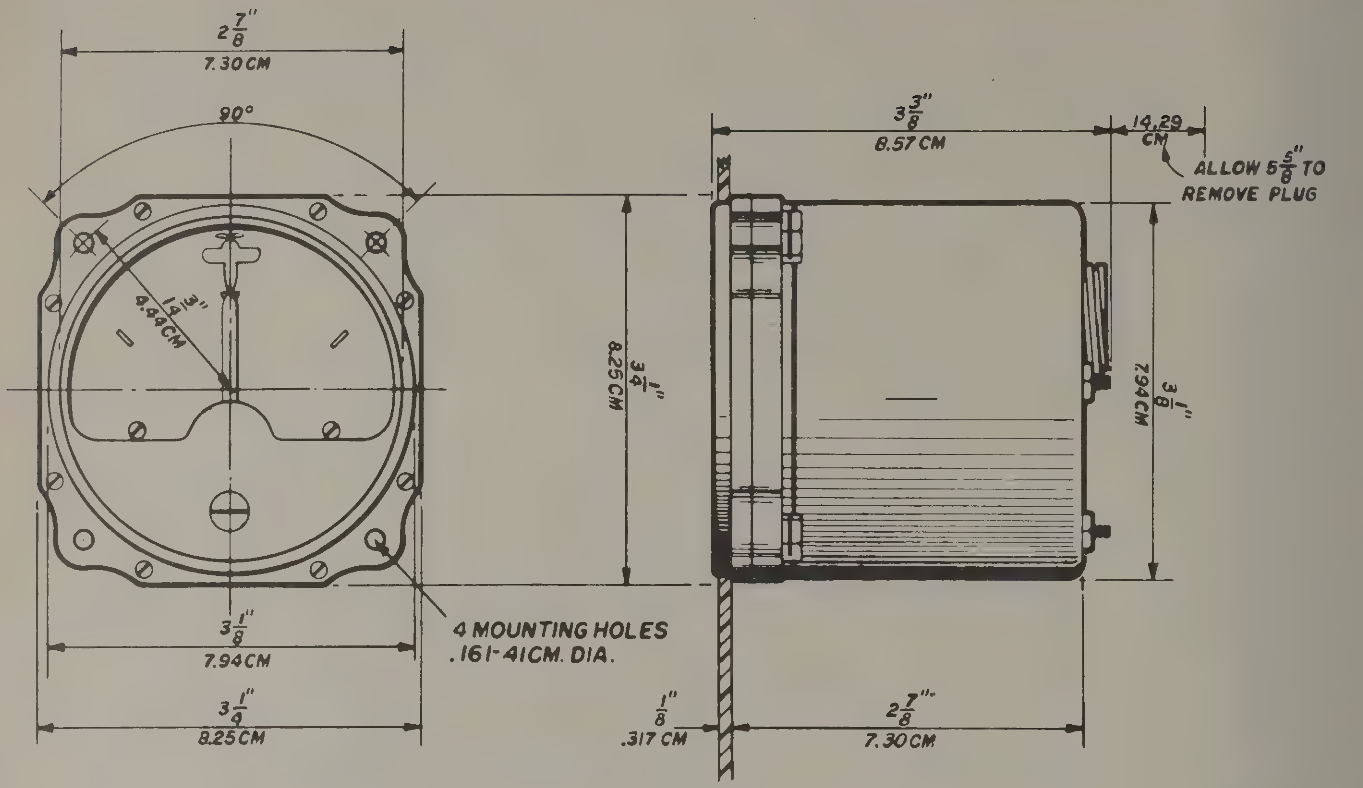


Figure 16—Type IN-4A Left-Right Indicator, Outline and Mounting Dimensions

For general information on installation of open wiring refer to Air Corps Specifications numbers AN-J-C-48a and 32310-B. For details on the construction of cables see figure 49.

(2) The table below is useful in determining the electrical and mechanical characteristics of finished cables.

Securely bond or protect the loop transmission cable K55966 with friction tape wherever it touches another metallic surface.

(5) Do not alter the length of the loop transmission cable unless the required characteristics of the original cable can be exactly duplicated. This cable is of special construction with the wires ar-

Cable Designation	*Nominal Conductor Area*	*Number of Wires*	*Max. Resistance of Finished Cable (Ohms per 1000 Feet, at 20° C., 68° F.)*	*Max. Diameter of Stranded Conductor*	*Max. Diameter of Finished Cable (Inches)*
AN-20	1179	7	10.25	.040	.100
AN-18	1779	7	6.44	.050	.115

(3) The equipment and cables must not interfere with the aircraft controls nor with the other instruments or equipment. (Fig. 49 shows a typical interconnection.)

(4) Securely fasten the electrical and mechanical cables in place, where necessary, to prevent abrasion or vibration. Cables connecting to the radio compass must be unsupported for a distance of two feet from the unit and should have enough slack to permit free action of the shock mounting.

ranged so that the capacity is between 150 and 170 micromicrofarads and the inductance of the two r-f wires connected in series is between 2 and 4 microhenries. It is supplied in standard lengths of 72, 112, and 168 inches.

A black #22 Lenzac wire runs straight through the conduit and is as long as the cable. The white-blue and the white-black wires are #22 Lenz wires and are each 168 inches long regardless of the length of the cable. These two r-f wires are folded back

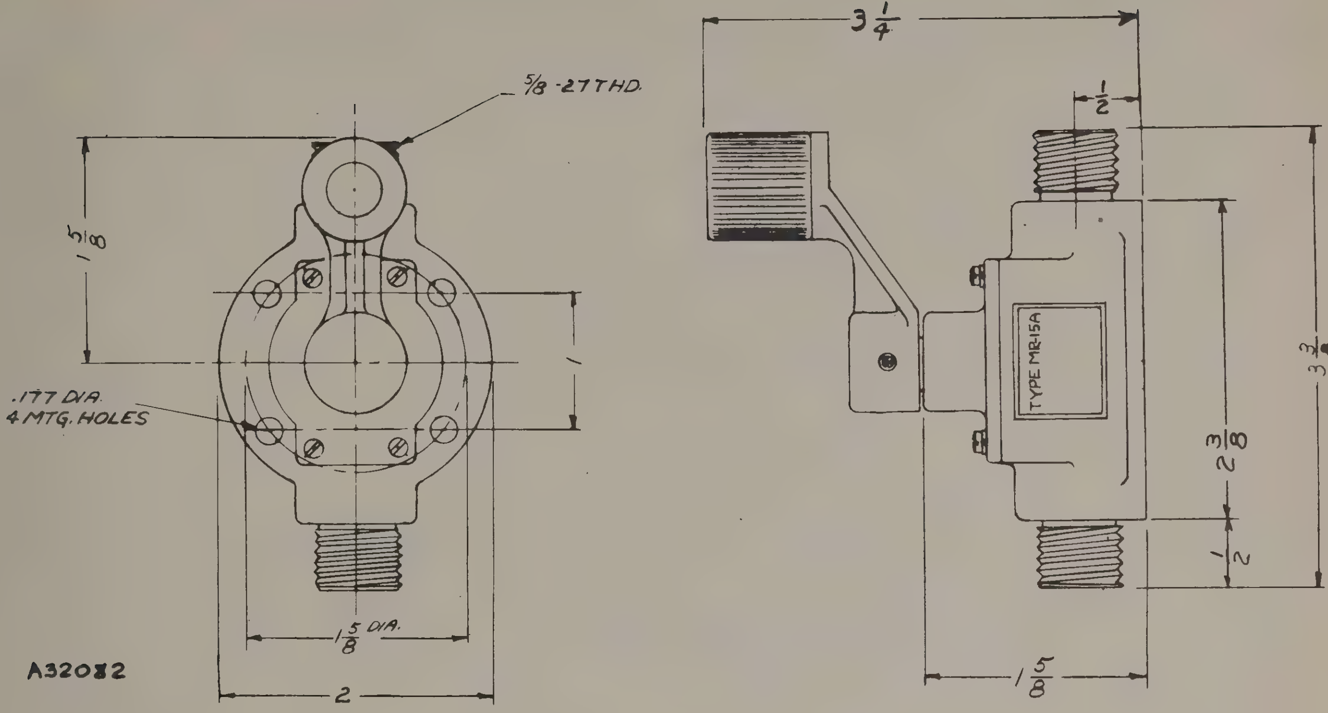


Figure 17—Type MR-15A Crank Drive, Outline and Mounting Dimensions

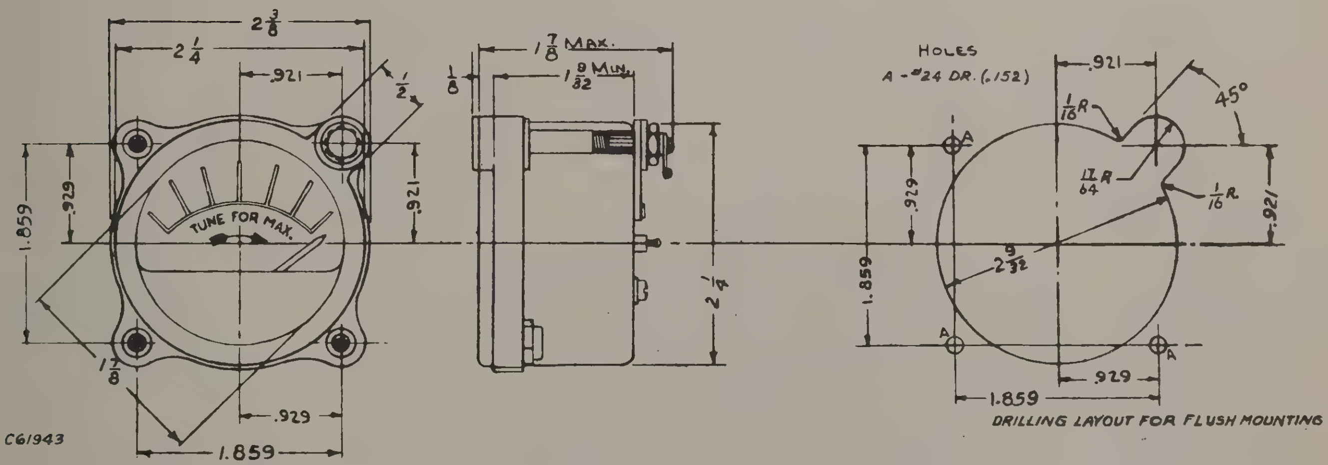


Figure 18—Type MR-57-A Tuning Meter, Outline and Mounting Dimensions

upon themselves until the requirements as to cable length, capacity and inductance are satisfied. The wires are tied or taped together, placed in the cable, and connected to the plug pins.

j. LOOP TUNING CABLE.—Connect the mechanical cables which link the loop to the azimuth indicator and crank drive so that the plane of the loop is perpendicular to the aircraft's line of flight when the azimuth indicator dial reading is zero. After setting the two units, tighten the shaft securely and check the installation by rotating the crank drive several degrees each way, then reset to the zero reading of the azimuth indicator. If the mechanical cable has been properly aligned, the dial scale will read zero when the loop is at right angles to the line of flight. It is also important that the loop drive be in the proper opening of the loop, otherwise the loop may not rotate in the same direction as the azimuth indicator, resulting in incorrect bearings. The correct combinations are shown in figure 19. A cover plate is provided to cover the opening not used by the loop drive. (See fig. 20).

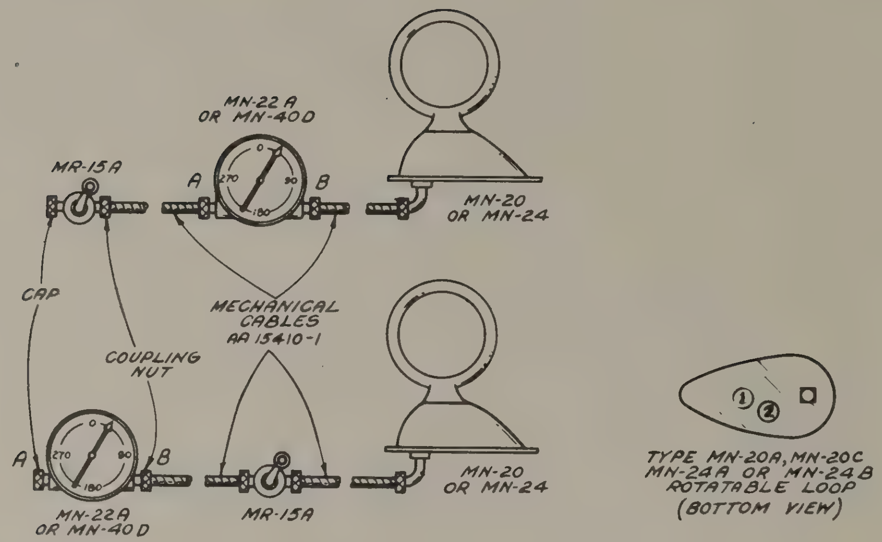


Figure 19—Loop Tuning Cable Connection

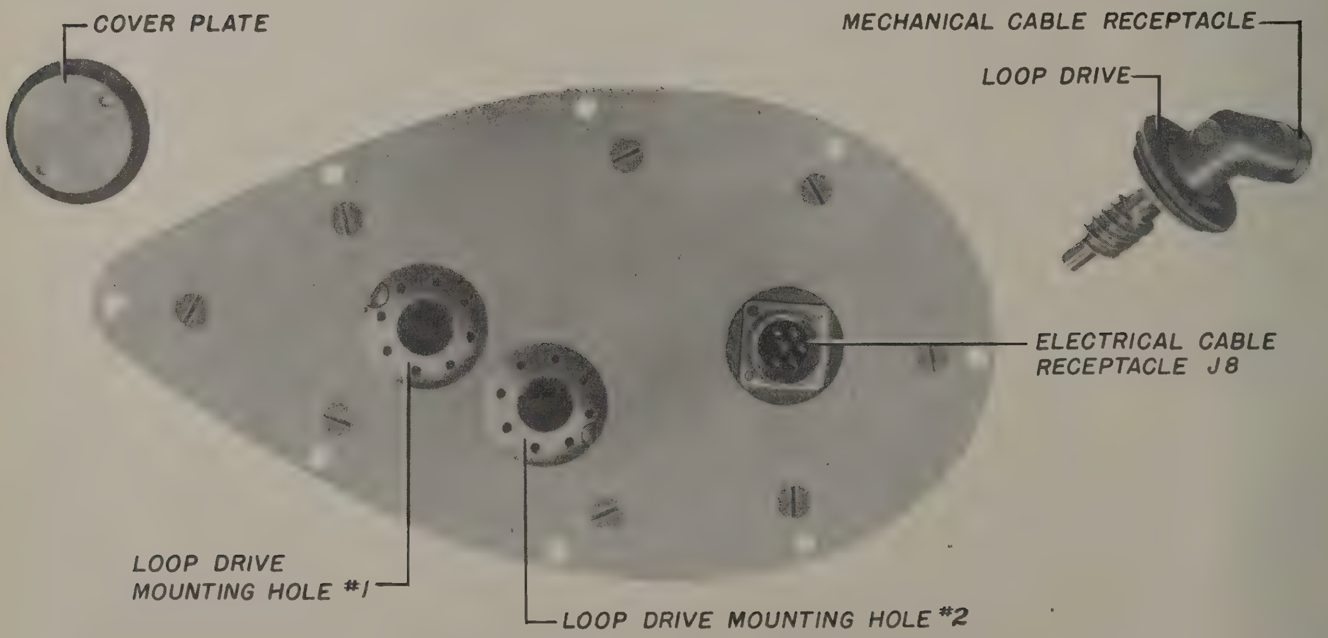


Figure 20—Type MN-20 or MN-24 Rotatable Loop, Bottom View

k. ALTERING THE LENGTH OF MECHANICAL CABLES.—The following is a simple method of cutting and terminating flexible mechanical cable shafts and conduits (armored housing) without special tools or equipment. (Refer to fig. 21 for nomenclature and location of parts.)

(1) Measure the conduit for length. It should be neither stretched nor compressed. First coil the conduit to approximately one foot in diameter and then carefully uncoil it on the surface on which it is to be measured. It can be cut to the measured length with a hacksaw. If the cable is cut at one end after installation within the aircraft, the shaft is usually inside the conduit. Take care when cutting the conduit so that no strands of the shaft will be fractured.

(2) After the conduit has been cut to length, mark the shaft about 1/4 inch beyond the end of the conduit. Press or push the conduit away from this mark. Next slip a coupling nut and a ferrule over the end of the housing. Tightly affix the parallel clamps to the shaft about 2 inches on each side of the mark. Then with a 200-watt soldering iron, tin the shaft with soft solder. Have the tinning extend about 1 inch on each side of the mark previously made on the shaft. After the shaft is thoroughly tinned cut it at the mark with a hacksaw.

(3) Before releasing the parallel clamp on the piece of shafting which is to be used, fasten the spline to the assembly. The spline must be well tinned inside of the hole which takes the shaft. Point the shaft downward and heat the spline. Hold it with a pair of pliers. When the spline is hot enough to freely melt solder within the upturned hole, force it carefully upward on the shaft until it is securely "seated" with the shaft touching the bottom of the hole. While the solder is still in liquid state, wipe away all excess with a heavy cloth.

(4) After the solder has cooled enough to solidify, release the pliers and parallel clamp. Stretch the conduit to its correct length. Then with a small center punch, dent the ferrule in four places around its periphery about 1/8 inch from the rear and again in four places about 1/4 inch from the first punch marks. Support the ferrule during this operation with a small metal block in which a "V" shaped slot has been cut. This completes the assembly.

l. RADIO COMPASS TO REMOTE CONTROL MECHANICAL CABLE.—If it is necessary to alter the length of the tuning cable see *k* above. Bond the tuning cable to the principal metallic structure of the aircraft at frequent intervals. The minimum bending radius of the tuning-shaft is six inches and not more than two six-inch, 90-degree bends should be made in any one cable installation. Several bends of larger radius or greater angles may be permitted, however.

(1) CONNECTING TUNING CABLE.—To connect the mechanical cable from Type MN-26* Radio Compass to Type MN-28 Remote Control:

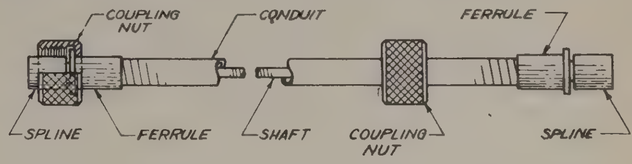


Figure 21—Mechanical Cable Construction

(a) Set the variable capacitor plates of the radio compass at maximum capacity (fully meshed) The stop in the gear box will prevent rotation beyond the maximum capacity.

(b) Set the band selector of the remote control unit to Band II.

(c) Rotate the "TUNING" crank until the "ALIGN" mark on the dial is centered under the index.

(d) Connect the mechanical cable between the receptacle of the remote control (see fig. 3) and the gear box receptacle of the radio compass (see fig. 2).

(e) Check the alignment by varying the "TUNING" crank and resetting the maximum variable capacitor setting (against the stop). The dial must reset on the "ALIGN" mark.

(2) CHANGE OF GEAR BOX POSITION.—The gear box, mounted on the front panel of the radio compass (see fig. 22), provides means for

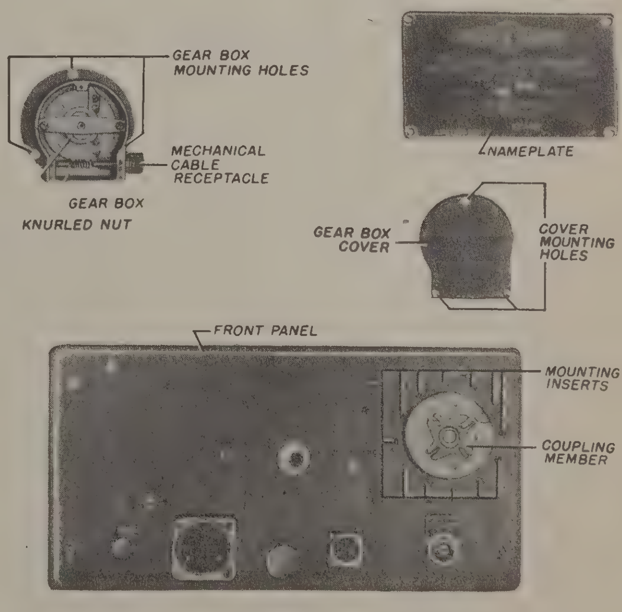


Figure 22—Type MN-26 Radio Compass, Gear Box*

obtaining the necessary reduction of rotation between the flexible shaft of the cable and the tuning capacitor. The flexible shaft connects through a spline and shaft to a worm which drives a split-spring-loaded worm gear provided with stops to limit the amount of rotation to 180 degrees. The hub of this worm gear is tapered to fit onto a similar taper on the gear shaft. The pressure for locking the gear onto the shaft is provided by a knurled nut. When this nut is loosened, the shaft may be turned to a setting without turning the gears. The shaft of the variable capacitor is fitted with a coupling member, which is a bar with a pin on each of the two tips; the shaft of the gear box is provided with a similar bar. The bars are coupled together, when the gear box is attached to the front panel, by a coupling. This coupling has four slotted arms which engage the pins on the variable-capacitor-bar and the gear-box-shaft-bar. The panel is provided with 12 inserts, 30 degrees apart in a circle, and the gear box is provided with 3 holes 120 degrees apart. This enables the gear box to be secured, with 3 screws, in any one of 12 positions. To run the mechanical cable to the unit with the minimum of bending, mount the gear box in one of the 12 positions following:

(a) Connect the remote control to the gear box on the compass with the mechanical cable and rotate the "TUNING" crank on the remote control in a **counterclockwise** direction until the gear box stops prohibit further rotation.

(b) Remove the cover from the gear box and loosen the knurled nut a fraction of a turn. This permits the gear box and the variable capacitor to be independently rotated.

(c) Remove the three screws which mount the gear box to the panel but do not pull the gear box forward as the coupling may be loose enough to become disengaged.

(d) Hold the variable capacitor in its maximum (fully meshed) position.

(e) Rotate the gear box to its new position, but do not allow it to fall forward. It may be necessary to pull the gear box slightly forward to allow it to pass the panel mounting screws in the upper right-hand corner of the panel or over the name plate. If desirable, remove the panel mounting screws until the gear box has been rotated to its new position. If the coupling becomes disconnected, reconnect it before continuing the adjustment. Secure the gear box to the panel with the three mounting screws.

(f) Tighten the knurled nut and replace the cover.

(g) With the mechanical cable still disconnected, rotate the "TUNING" crank until the "ALIGN" mark is centered under the index.

(h) Connect the mechanical cable between the remote control unit and the gear box on the radio compass. Rotate the "TUNING" crank throughout its range to see if minimum and maximum capacitance is obtained at the end points of the dial scales.

m. LOOP TRANSMISSION CABLE.—**Do not alter the length of loop transmission cable AC55966-1.** If it is too long, coil the excess wherever convenient. If alteration of this cable is **absolutely essential** precautions must be taken to adjust the inductance and capacitance to **exactly** that of the original Protect the cable with friction tape wherever it touches another metallic surface or bond it securely. Place one plug of the cable into receptacle J7 of the radio compass (see figure 2) and the other plug into the electrical cable receptacle J8 of the loop. (See fig. 20.)

3. TESTS AFTER INSTALLATION.

After the radio compass has been installed in the aircraft, make the following tests before placing the equipment into service:

a. Before turning the radio compass on, check the battery voltage and polarity at the remote control. The voltage on the fuse terminals must be +22 to +30 volts (11 to 15 volts for 14-volt installation) with respect to ground, regardless of engine speed.

b. Check vacuum tubes to see that they are securely seated in their sockets. Check that the grid clips and grid shield caps are making positive contact and are not shorting.

c. Test operation of mechanical cables and connections. When properly connected, the "ALIGN" mark on the remote dial is centered with the ganged condenser at maximum.

d. Check radio compass mounting base screws.

e. Check remote control for tightness of mounting to aircraft structures, and check mounting screws on panel for tightness.

f. Check non-directional antenna and see that connections are properly and securely made.

g. Be sure that the loop transmission cable is supported, taped, and bonded. Check tightness of ferrule couplings on the plugs.

h. Check for presence and operation of instrument lights. Also check lamp controls.

i. Using a headset, check receiver operation on all three bands, then check compass operation and indicator response. Jar the compass unit to check for possible sources of noise.

j. Switch compass on and off and note whether or not the airplane's magnetic compass is affected.

k. Check for the effects of other radio equipment in the aircraft upon the communicational and navigational performance of the radio compass. Also determine the extent of any interference produced by the radio compass in other radio equipment.

l. Turn "OFF-COMP.-REC. ANT.-REC. LOOP" switch (see fig. 3) to "COMP." and head the plane toward a transmitting station of known direction. Set the azimuth indicator for 0 azimuth dial reading to give on-course indications on the left-right indicator. Turn the azimuth indicator about 15 degrees to the right of the transmitting station and observe the left-right indicator. The pointer of the left-right indicator should deflect toward the left of the dial. Repeat test, turning the azimuth indicator 15 degrees to the left of the transmitting station. The indicator pointer should deflect to the right of the dial. If the sense indication is wrong, disconnect the mechanical cable from the azimuth control, rotate the azimuth indicator 180 degrees, and again connect the mechanical cable onto the azimuth indicator.

m. With "AUDIO" control at maximum, stop the engine and tune through each band. Note the noise level. Repeat test with the engines running at various speeds. If any appreciable increase in noise is noted with the engines running at any speed, improve the aircraft shielding and bonding and the battery circuit filtering.

4. LOOP GAIN ADJUSTMENT.

The function of loop gain control R1 is to provide the proper ratio of loop signal to vertical antenna signal. The control is located on the left side of the compass unit chassis. (See fig. 44.) The adjustment procedure is as follows:

a. Take the airplane to a place removed from buildings, power lines, fences, etc. (If the vertical antenna used with the compass unit is installed underneath the fuselage of the aircraft make the adjustments while the aircraft is in flight, as the pick-up of the vertical antenna will be affected by its proximity to ground.)

b. Turn loop gain control fully counterclockwise and set the "OFF-COMP.-REC. ANT.-REC. LOOP" switch at "COMP." position.

c. Tune in a strong signal and rotate the loop until on-course indication is obtained on the left-right indicator.

d. Rotate loop 90 degrees and "back-off" on "COMPASS" control R3 (see fig. 3) until a less than full-scale deflection of the left-right indicator is obtained.

e. Turn loop gain control R1 slowly in a clockwise manner until further clockwise adjustment no longer results in increased indicator deflection, readjust "COMPASS" control R3 if necessary to keep the indicator needle within scale limits.

5. THRESHOLD SENSITIVITY ADJUSTMENT.

The threshold sensitivity control R2 is mounted in the remote control unit. (See fig. 38.) After the loop gain control has been adjusted, turn the threshold sensitivity control fully clockwise, and tune with no signal applied the receiver to the point of maximum noise and meter deflection. This should occur in the low frequency band. (Conduct this test in a location that is as free as possible from interference or static to keep the amount of externally generated noise at a minimum.) Turn the threshold sensitivity control R2 (see fig. 38) counterclockwise until the indicator deflection is not over three-quarters full scale.

6. QUADRANTAL OR AIRCRAFT ERROR CALIBRATION.*

a. GENERAL.—It will be necessary to check the direction of radio bearings every 15 degrees from the fore-aft axis of the aircraft in order to determine and compensate the deviations caused by distortion of the radio field pattern due to wings, engines, propellers, antennas, and other parts of the aircraft.

This check is to be made with the airplane in flight according to the procedure outlined in paragraph 6*c*, following. A temporary calibration may be made on the ground for installations in which the loop is on top of the airplane; a permanent calibration should be made later according to the regular procedure.

. Aircraft radio compass error increases with frequency so that the greatest errors will occur at the highest frequencies used for radio compass operation. Consequently, calibration should be made on at least one station in each band and on frequencies most generally used, where greatest accuracy is required. Accurate bearings may generally be obtained on stations in the frequency range from 200 to 1000 kc. The error caused by a change in frequency from 200 to 1000 kc. usually should not exceed 3 degrees. When calibration data obtained at the mid-point of this range is used for compensation of the loop, bearings read directly from the azimuth indicator at any other frequency between 200 and 1000 kc should not generally be in error by more than 2 degrees. Errors due to sharp discontinuities in the quadrantal error curve will be variable with frequency. These discontinuities are probably caused by resonant structures (usually antennas), and it is important that the loop be so located with respect to such structures that the quadrantal error curve is smooth and essentially sinusoidal.

b. RADIO COMPASS CALIBRATION ON THE GROUND.—(Temporary procedure applicable to installations with loop mounted above fuselage.)

* For additional information on aircraft compass correction refer to Technical Order No. 08-5-29.

(1) GENERAL.—The calibration may be made on the ground by one of two methods; either by moving a portable radio transmitter around the aircraft at a distance of at least 1000 feet in a clear and open field, or by using a fixed radio station and turning the aircraft on a compass rose.

Make checks at 15-degree intervals, or at 10- or 5-degree points if greater accuracy is required.

(2) PORTABLE TRANSMITTER METHOD.—Below is the procedure to be followed when a portable radio transmitter is moved around the aircraft.

(a) Locate the aircraft in the center of a clear and open field at least 2000 feet in diameter. The aircraft must be in flying position.

(b) Locate a portable transmitter in line with the fore-and-aft axis of the aircraft so that the aircraft heads towards the transmitter. Use an accurate means of alignment such as an engineer's transit, or pelorus, located on top of the aircraft. The portable transmitter should have sufficient power (5 to 100 watts) to override any external interference and should use a vertical rod or mast 10 to 50 feet high for an antenna.

(c) Set the transit or pelorus to zero degrees when the line of sight from the pelorus to the transmitter coincides with the center line of the aircraft.

(d) Tune the radio compass in the aircraft to the frequency of the portable transmitter. Choose a transmitter frequency free of interfering signals, and preferably in the frequency range that will be used most of the time for radio bearings.

(e) Rotate the loop until on-course indication is obtained. The bearing reading of the azimuth indicator should be zero if previous adjustments were made correctly. Record this reading for the zero heading of the aircraft on a form similar to that shown in figure 24.

(f) Move the portable transmitter, at a radius of at least 1000 feet, through an angle of 15 degrees with respect to the axis of the aircraft. as determined by the line of sight of the transit or pelorus mounted on the aircraft. Rotate the loop until on-course indication is obtained on the left-right indicator. Note and record the reading of the azimuth indicator for the 15-degree position of the transmitter.

(g) Move the transmitter 15 degrees from its position in the preceding paragraph at a radius of at least 1000 feet so that the line of sight from the aircraft to the transmitter makes an angle of 30 degrees with the axis of the aircraft. Rotate the loop until on-course indication is obtained. Note and record the reading of the azimuth indicator for the 30-degree position of the transmitter.

(h) Repeat the above procedure for transmitter positions at 15-degree (or less) intervals until the transmitter has been moved through 360 degrees around the aircraft.

(i) Plot a correction curve of the results obtained on the graph sheet as described in paragraph 7, this section.

(j) Repeat the calibration for different frequencies. Be sure to indicate the calibrating frequency on each calibration curve obtained.

(3) FIXED TRANSMITTER METHOD.—Calibration of the equipment on the ground from a fixed radio station may be made at the same time the magnetic compass is calibrated. The procedure is given below.

(a) Locate the aircraft on a compass rose. **The aircraft must be in flying position.** The site of the test should be clear of all buildings or obstructions. If a compass rose is not available, one accurate heading toward the selected radio station must be determined and means provided for measuring the angle of aircraft heading with respect to the radio station heading. Measure this angle by using a transit or pelorus setup on top of the aircraft and sighting on some fixed object at least 1000 feet distant from the plane.

(b) Select a high-powered, clear-channel radio station from 10 to 100 miles distant, or use a suitable portable transmitter as described for the preceding method. The station should normally provide good bearings with practically no fluctuation of the left-right indicator needle.

(c) Tune the radio compass receiver to the transmitter frequency used, and accurately head the aircraft toward the transmitter. Rotate the loop for an on-course indication on the left-right indicator needle. Set the azimuth scale zero mark on the azimuth indicator to the zero index mark. Note and record the pointer reading of the azimuth indicator for the zero-degree heading of the aircraft. The azimuth indicator reading should be zero degrees if the installation and all adjustment have been made correctly.

(d) Swing the heading of the aircraft through an angle of 15 degrees (or less) from the original zero heading above. Rotate the loop for an on-course indication. Note and record the bearing reading of the azimuth indicator. Reading should increase.

(e) Increase the heading of the aircraft by 15 degrees so that a heading of 30 degrees with respect to the original zero heading is established. Rotate the loop for an on-course indication. Note and record the pointer reading of the azimuth indicator.

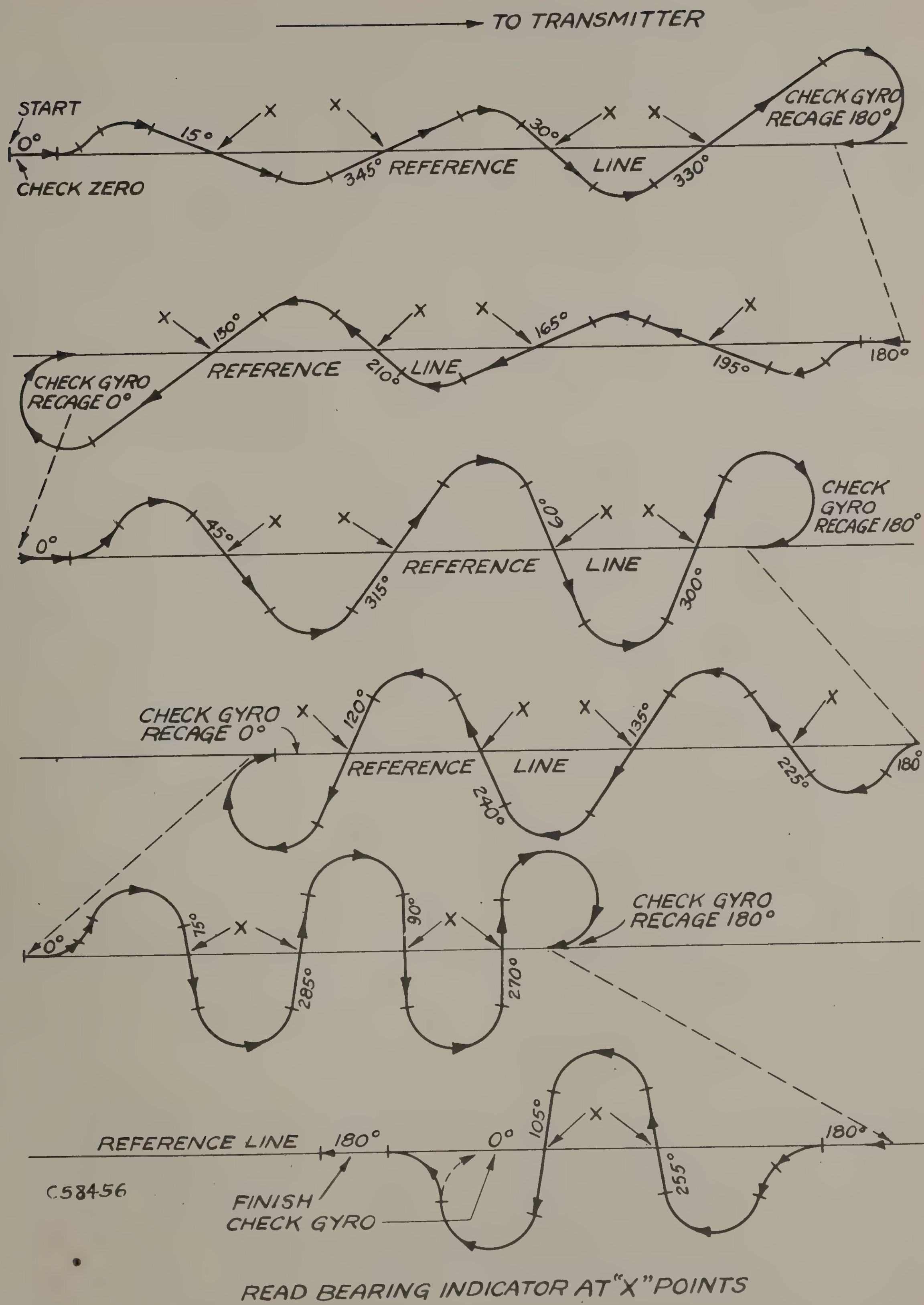


Figure 23—Quadrantal Error Calibration Flight Pattern

(f) Repeat the above procedure for every 15-degree increase in heading of the aircraft until the aircraft has been turned through 360 degrees.

(g) Plot a correction curve of the results obtained on the graph sheet as described in paragraph 7*a*, this section.

(h) Repeat the calibration for different frequencies. Be sure to indicate the calibrating frequency on each calibration curve obtained.

c. RADIO COMPASS CALIBRATION IN THE AIR.

(1) GROUND REFERENCE—LINE METHOD.—Calibration may be accomplished in the air as follows:

(a) Select a medium or high powered radio station between 25 and 100 miles distant from the locale at which the test is to be conducted. The radio station selected should not be in a congested channel where high powered adjacent channel signals can, by slight mistuning, cause bearing errors. The station should normally provide good bearings with little or no fluctuation of the compass indicator needle.

(b) Select a day when the wind is less than eight miles per hour in order to avoid excessive drift angles, and when the air is smooth in order to avoid errors in reading the bearing angles. Do not make the calibration within one hour of sunrise or sunset or when wide fluctuations of bearings are noted.

(c) At some time prior to take-off, rotate Type MN-40D Azimuth Indicator, or Type MN-22A Azimuth Control (whichever is used) to see that there is no correction set up on the instrument. Turn the pointer of the MN-40D azimuth indicator, or the MN-22A azimuth indicator (whichever is used) by means of the Type MR-15A crank to successive 15-degree positions of the inner dial scale (as seen through the small window beneath the word "RADIO COMPASS"). See that the indicated bearings correspond to these inner dial readings. The outer dial zero should be at the index mark, and care should be taken not to move the "VAR." knob during this check.

(d) Select a landmark or series of landmarks (such as a road, railroad track, section lines, etc.) which will provide a direct line toward the radio station. Since power lines or railroads on or adjacent to the landmark can distort the radio path, check to determine whether or not distortion is present. Do this by crossing the power line at various angles while maintaining fixed courses by means of the directional gyro. If the bearing changes rapidly as the line is approached, distortion is present and should be eliminated by flying at a greater elevation, or by selecting a new reference landmark.

(e) With the aircraft in level flight, fly along this reference line at an altitude low enough to avoid parallax error. If the airplane has a drift meter installed, it can be used to insure that the direction of flight is parallel to, or directly over, the reference line. Set the directional gyro to zero, and rotate the loop to obtain "ON-COURSE" indication on the Type IN-4A Left-Right Indicator. When passing over some predetermined point or intersecting line to the reference, record simultaneously the bearing indicator reading and the directional gyro reading. Also record the drift meter reading if a drift meter is being used. The above readings, if the previous setting and the line of flight have been maintained, should be zero. This maneuver, as well as those discussed in the following paragraphs are indicated by figure 23. In practice, it will be found practicable to have the co-pilot use figure 23 to direct the pilot and to maintain the airplane's location at all times with respect to the flight pattern shown.

(f) Turn the aircraft to the left, and then swing back to the right, crossing the reference line at an angle of 15 degrees by the directional gyro. The pilot should be instructed to swing far enough out on these maneuvers to regain level flight some distance before the reference line is reached. Readings should be made only during conditions of level flight. Have the pilot inform the radio compass operator at the instant the airplane crosses the reference line. Record the radio compass bearing for that instant in the indicated place in column 3 on figure 55. Greater accuracy can be obtained in installations with a drift meter since the drift meter observer can determine the exact moment of crossing the reference and can read the heading at that exact flight position.

(g) Repeat the above procedure throughout step I of figure 23, recording the data in the third column of figure 55; return on the reference line as shown in step II. Reset the directional gyro each time a new step is begun.

(h) Repeat the above procedure until the entire flight pattern of figure 23 has been flown.

(i) During the above procedure, take care to avoid parallax in reading the instruments, and to set the directional gyro accurately. Make one or two check runs to attain best accuracy.

(2) SUMMARY—Calibration data obtained for a particular type of airplane is usable without modification for all airplanes of that type, if the location of the loop and other antennas is the same. Since all airplanes of the same type may not have the same radio installations, an accurate diagram with antenna dimensions and exact loop location will add to the usefulness of the recorded data (figure 55).

STATION USED CW ___ FREQ. 400 Kcs.

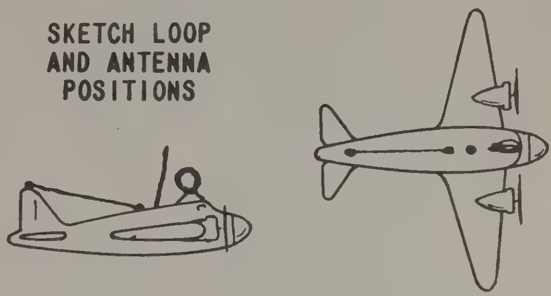
PLANE NO. NC 6583 PILOT J. Doe

RECORDER G.O.E. DATE 10-30-43

REF. MARK QUAD. POSITION 0° ✓ 90° ___ 180° ___ 270° ___

LOCATION U.S. highway #75 between Centerville and Laketown

SKETCH LOOP AND ANTENNA POSITIONS



GYRO HEADING	PLANE TO RADIO STATION BEARING (TRUE RADIO BEARING)	OBSERVED RADIO BEARING (INDICATED ON MN-22A)	BEARING CORRECTION (COLUMN 2 MINUS COLUMN 3)	CAM SCALE (OF MN-22A)	CAM CORRECTION FOR MN-22A (FROM CURVE)
COLUMN 1	COLUMN 2	COLUMN 3	COLUMN 4	COLUMN 5	COLUMN 6
0	0	0	0	0	0.0
15	345	350	-5	15	+7.0
345	15	10	+5	345	-7.5
30	330	339	-9	30	+9.5
330	30	22	+8	330	-10.5
180	180	180	0	45	+10.5
195	165	170	-5	315	-10.5
165	195	190	+5	60	+9.0
210	150	159	-9	300	-8.0
150	210	201	+9	75	+5.0
0	0	0	0	285	-4.0
45	315	326	-11	90	+0.0
315	45	35	+10	270	+0.0
60	300	310	-10	105	-5.0
300	60	50	+10	255	+5.0
180	180	180	0	120	-9.0
225	135	146	-11	240	+9.0
135	225	214	+11	135	-11.5
240	120	131	-11	225	+11.5
120	240	229	+11	150	-10.5
0	0	0	0	210	+10.5
75	285	291	-6	165	-7.0
285	75	68	+7	195	+7.0
90	270	270	0	180	+0.0
270	90	90	0		
180	180	180	0		
255	105	112	-7		
105	255	248	+7		
180	180	180	0		

EXAMPLE ONLY
DO NOT USE

Figure 24—Sample Quadrantal Error Data Sheet

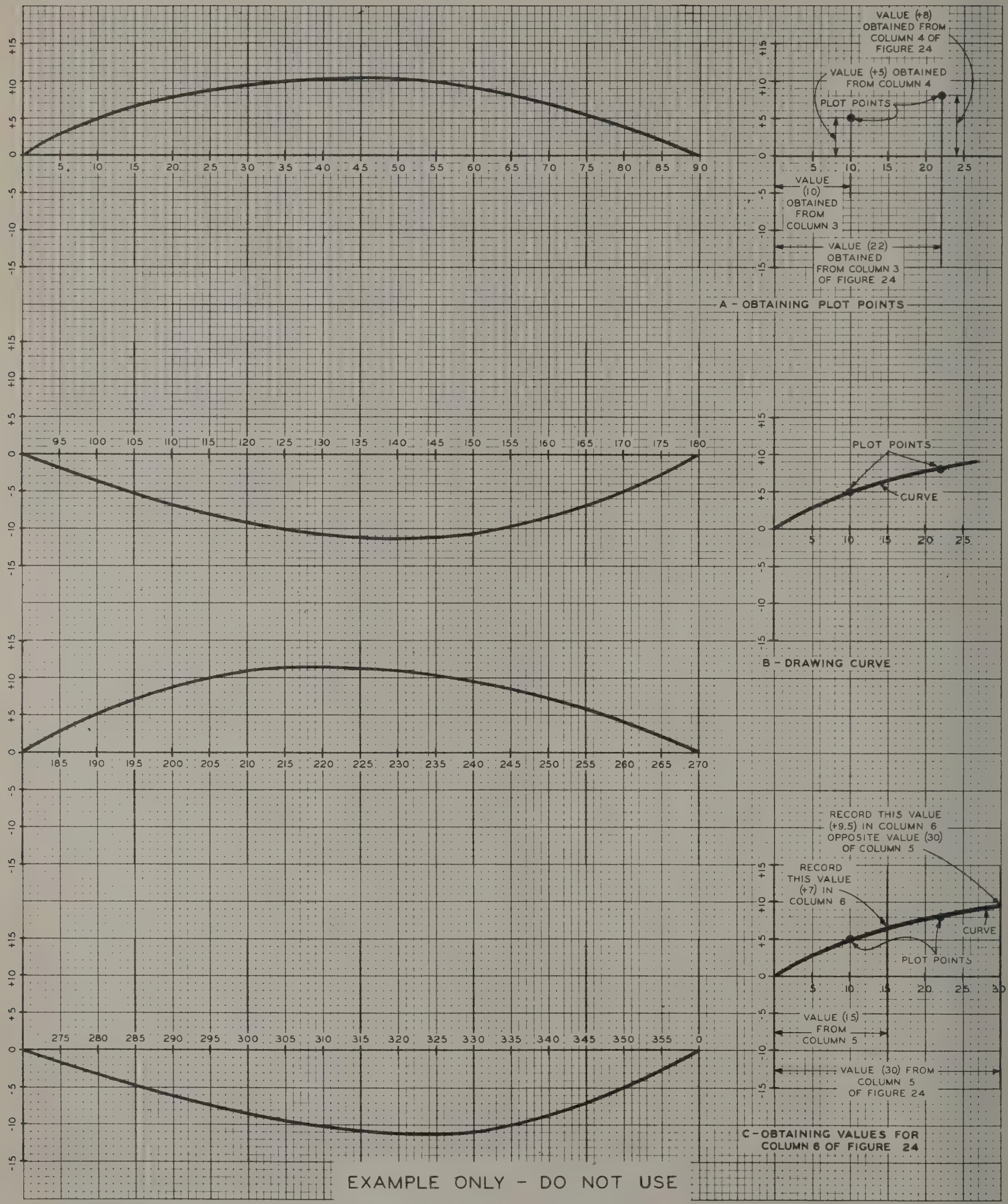


Figure 25—Sample Quadrantal Error Calibration Curve

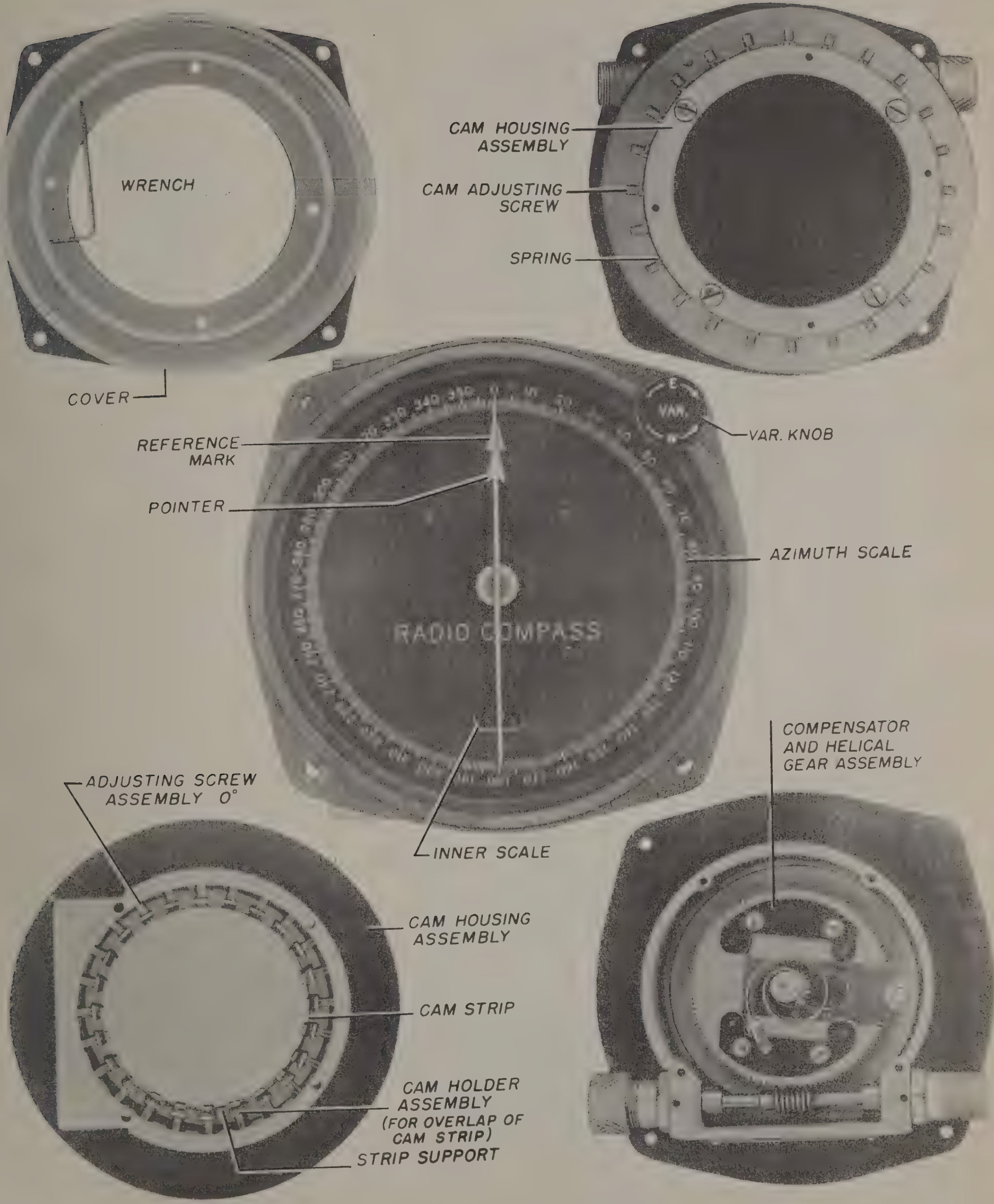


Figure 26—Type MN-40D Azimuth Indicator, Disassembly

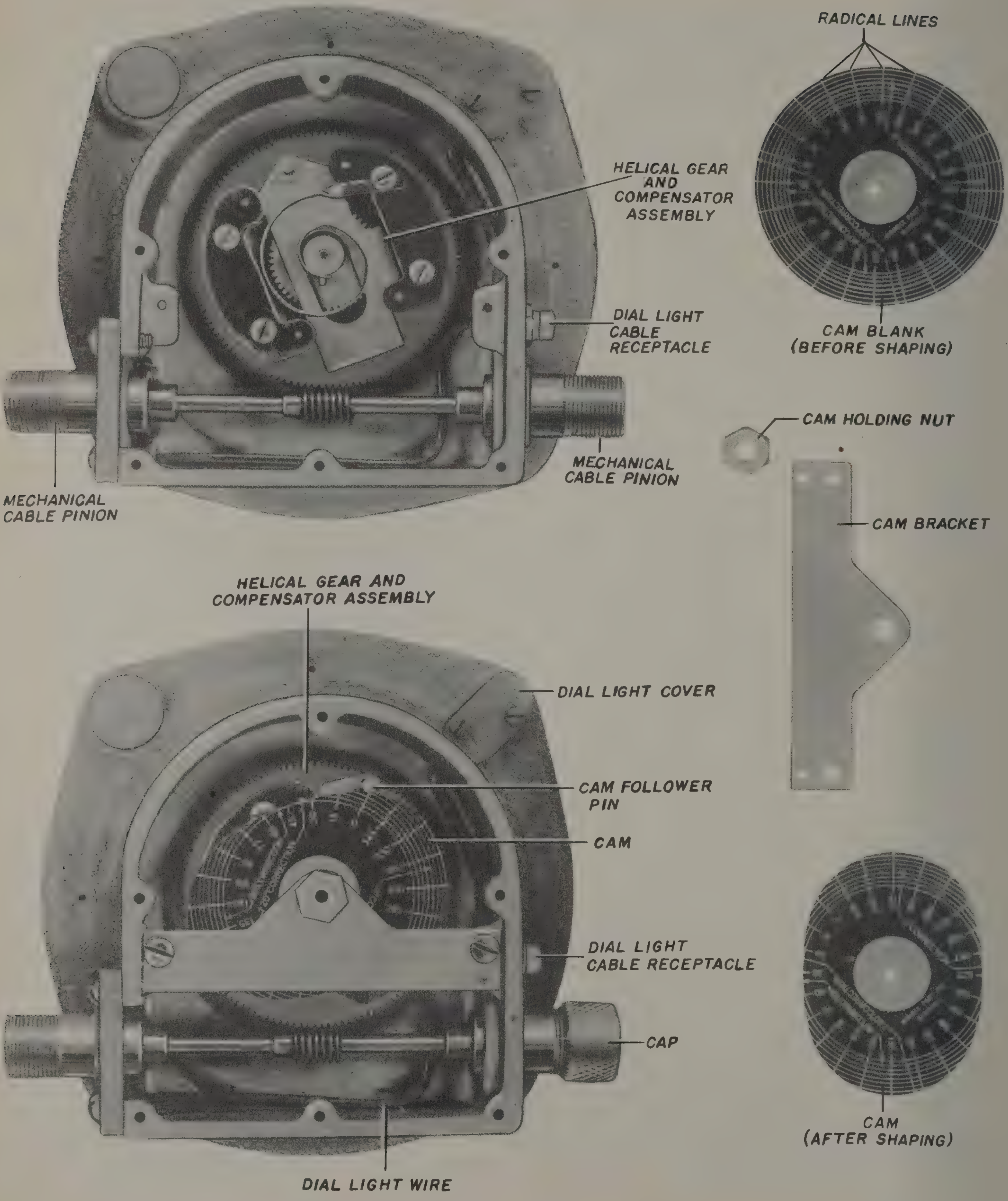


Figure 27—Type MN-22A Azimuth Indicator, Disassembly

NOTE

Since radio compass deviation changes to some extent with frequency, take calibration data at several frequencies to insure greatest accuracy in use. The readings used to set up the radio compass deviation compensators on the indicators should be those obtained at some frequency between 200 kc and 1000 kc, since in that frequency range the radio wave characteristics are better suited to radio compass use. Under service conditions, and with the bearing indicator properly compensated, the overall radio compass deviation should not exceed three degrees except at points of large rate of change of error between 15-degree rhumb lines or sectors.

7. AZIMUTH INDICATOR COMPENSATION.

NOTE

For installations using the Type MN-40D azimuth indicator follow the procedure covered in Technical Order No. 08-5-29. For installations using the Type MN-22A indicator the following directions apply.

a. After the radio compass deviation has been determined according to paragraph 6, this section, it may be compensated so that correct bearings may be read directly from the bearing pointer. Although the corrections can be compensated by direct reference to the observed data, it is more practicable, because of the design of the bearing indicator compensator, to plot the data and interpolate on the curve.

DETERMINATION OF CORRECTION DATA.

(1) Find the differences between the values listed in columns 2 and 3 and record these values in column 4 of figure 55. Where column 2 is larger than column 3, place a **plus** sign in front of the value in column 4, and where column 2 is **smaller** than column 3, place a **minus** sign in front of the value in column 4. An example is given below and in figure 24.

Plane to Radio Station Bearing (True Radio Bearing)	*Observed Radio Bearing (Indicated on MN-22A)*	*Bearing Correction (Column 2 Minus Column 3)*
Column 2	*Column 3*	*Column 6*
0	0	0
		Column 2 is smaller than column 3 by 5; therefore a –5 is placed in column 4 (345-350=–5)
345	350	–5
		Column 2 is larger than column 3 by 5; therefore a +5 is placed in column 4 (15-10=+5)
15	10	+5
330	339	–9
30	21	+9

Complete column 4 of figure 55 in this manner, then plot these values on the graph of figure 56.

(2) Locate plot points on the graph of figure 56 from the values in column 3 and column 4 of figure 55. The values in column 3 are located on the horizontal axis (four lines running across the page). The values in column 4 are located by counting up (for plus values) or down (for minus values) from the horizontal axis. An example is given in "A" of figure 25.

After all the plot points are located on the graph for all the values in column 3 and column 4, a line is drawn through these plot points to form a smooth curve. An example is given in "B" of figure 25 and the completed curve obtained from column 3 and column 4 of figure 24 is plotted on figure 25.

(3) Determine the values in column 6 for each of the values listed in column 5 of figure 55 from the curve of figure 56. The 15-degree values of column 5 are heavy vertical lines along the horizontal axis of figure 56 and the values for column 6 are found at the point where the curve crosses the vertical 15-degree marks. An example is given in "C" of figure 25.

b. CAM SHAPING. (See fig. 27.) Cut the cam so that corrected bearings may be read directly from the dial. Since the cam is cut for one frequency only, it should provide correction at the most generally used frequency. In some instances the errors will hold to within one or two degrees over the frequency range of 150 to 1500 kcs.

(1) Before cutting the cam, prepare correction data as described in the preceding paragraphs 7*a* (1) through (3) inclusive.

(2) Disassemble the cam assembly as follows:

NOTE

Before uncoupling the loop tach-shaft, preparatory to removing the azimuth control set the pointer on zero. Make sure that the shafting does not rotate from this position during the time in which the azimuth control is uncoupled.

(a) Remove the back cover by unfastening the six screws.

(b) Remove the cam supporting bracket.

(c) Unscrew the cam holding nut and remove the cam blank from the cam bracket.

(3) The azimuthal bearings of the loop (column 5 of figure 55) are indicated on the cam blank by the radial lines spaced 15 degrees apart. The circles on the cam represent degrees of correction (column 6 of figure 55) and the distance between each circle is equivalent to five degrees. It will be noted that the maximum plus correction of 20 degrees is the outside diameter of the cam (for correction of minus 20 degrees quadrantal error). A plus correction advances the indicator pointer relative to the loop. With a sharp pointed scribe, lay out on the cam blank the contour indicated by the values listed in column 5 and column 6 of figure 55. A mark is made on the cam at the point where the (column 5 value) radial line intersects the (column 6) correction circle. A point should be marked at each radial line. Scratch a smooth connecting line through all the points. This line represents the contour of the cam. Sudden breaks in the contour usually indicate that a mistake has been made, so check the cam layout at these points. Using first a coarse and then a fine file, carefully file away the cam to the contour line. The edge of the cam should be smooth and free from file marks.

(4) Reassemble the cam in the cam bracket with a lockwasher and nut. Do not fully tighten the nut. Assemble the cam bracket in the casting making the pointer at zero degrees on the dials and adjust the cam so that the zero-degree radial line is lined up with the mark on the cam follower pin. Tighten the nut.

(5) To check the cam assembly and contour, refer to the calibration curve. Set up the loop azimuth bearings as indicated on the cam by the cam follower pin, by revolving the coupling shaft. The pointer should read the corresponding true bearings. Settings hidden from view by the cam holder can be checked by counting the revolutions of the coupling shaft, as one complete turn of this shaft rotates the cam follower pin three degrees. Reassemble the back cover.

(6) If installation requirements have made it necessary to shift the zero position of the dials after the cam has been calibrated and filed, the cam will have to be set so that the cam follower pin is at zero on the cam when the pointer is at zero on the dials.

(7) Before recoupling the indicator to the loop shaft, set the pointer on zero and make certain that the loop has not shifted from its zero-degree heading.

c. FLIGHT CHECK.

(1) Fly all, or selected portions, of the original course and record the data as per paragraph 6c, this section.

(2) The bearing indicator pointer reading, with the scale set for zero index, should agree with the figures of column 2 of figure 60, within ±3 degrees for each 15-degree interval directional gyro heading.

d. RECOMMENDED PRELIMINARY INSTRUCTION.—To obtain a practical knowledge of the above method of plotting the deviation curve and adjusting the compensators, it is recommended that the instructions of paragraph 7a, above, be used in conjunction with figures 24 and 25 to set up a sample azimuth indicator.

8. PERFORMANCE TESTS.

a. NORMAL RADIO RECEPTION.—To check normal radio reception:

(1) Set master switch on the remote control box to "REC. ANT."

(2) Plug a telephone headset into "TEL" jack.

(3) Turn "AUDIO" control to maximum.

(4) Allow about 40 seconds for the tube heaters to reach their operating temperature.

(5) Turn band selector switch to Band I.

(6) Operate "TUNING" control until a signal is heard.

(7) Vary "AUDIO" control and note if smooth reduction of volume is obtained.

(8) Tune in several stations and note if the selectivity is good.

(9) Turn band selector switch to Bands II and III each time checking "AUDIO" control action and selectivity on several stations.

b. ANTI-STATIC RADIO RECEPTION.—To check anti-static reception:

(1) Set the function switch to "REC. LOOP."

(2) Repeat instructions in sub-paragraphs 8a (2) to (6) above.

(3) Operate crank drive until maximum signal is heard in the headset.

(4) Repeat instructions in sub-paragraphs 18a (7) to (9) above and operate the crank drive each time for maximum signal in the headset.

c. DIRECTION FINDING.—To test direction finding performance:

(1) Set the function switch to "COMP."

(2) Set aircraft in flying attitude headed toward true north.

(3) Tune in the signal from a weak station of known direction and rotate the crank drive until on-course indication is obtained on the left-right indicator, noting whether the azimuth indicator reading, as corrected for deviation, corresponds with the known direction of the transmitter.

SECTION III
OPERATION

1. OPERATION AND FUNCTIONING OF CONTROLS.

(These controls described are indicated on figure 28, by a figure and letter [such as a1] which refers to the part of this paragraph which describes the control.)

a. TYPE MN-28 REMOTE CONTROL.—The functions of the controls on the remote control panel are as follows:

(1) "OFF-COMP.-REC. ANT.-REC. LOOP." A 4-position selector (a1) selects the following desired operating function.

(a) The "COMP." setting is used for obtaining communications reception, visual on-course indication of homing and bearings. (Bands I and II only, on some models.)

(b) The "REC. ANT." setting is used for communication and aural radio range reception.

(c) The "REC. LOOP" setting is used for obtaining communications reception during conditions of severe rain and snow static, aural radio range reception, aural null bearings, and aural null homing from communication station. (Bands I and II only, on some models.)

(d) The "OFF" setting opens all current consuming circuits, thus rendering the equipment inoperative.

(2) "AUDIO."—The "AUDIO" control knob (a2) regulates the level of the audio signal in the headsets. This control is a dual potentiometer (R4A and R4B) connected in the r-f amplifier cathode circuits and the headsets. When functioning as a compass, the equipment is operating on automatic volume control (AVC) and this knob (R4A section) determines the audio level in the headsets. When the equipment is functioning as a receiver, on either "REC. ANT." or "REC. LOOP" this control varies the gain of the radio frequency amplifiers, permitting radio range reception.

(3) "COMPASS."—The "COMPASS" control (a3) operates a potentiometer R3 to regulate the extent of pointer deflection (amount of swing of c3 toward c2 or c4) of the left-right indicator.

(4) "C. W. ON-OFF."—This toggle switch S10 (a4) places the beat frequency oscillator in the circuit when in the "ON" position.

(5) "FUSE."—This fuse FU1 (a5) protects the circuit elements of the equipment from on overload.

(6) "TEL." JACKS.—The two jacks, J1 and J2 (a6), receive standard two contact (barrel and tip) headset plugs.

(7) "TUNING."—The "TUNING" crank (a7) operates the dial (a11) and controls the variable capacitor thereby selecting the operating frequency.

(8) "LIGHT."—This control, R6 (a8), adjusts the brilliancy of the dial light (a10).

(9) "CHANNEL SELECTOR."—This three-position switch, S9 (a9), energizes the band switch motor to select the desired frequency range and places a mask over the dial (a11) which permits viewing only that part of the dial associated with the channel in use.

(10) DIAL LIGHT.—Lamp LM-1 (a10) illuminates the dial (a11) and is controlled by the "LIGHT" control (a8).

(11) DIAL.—This dial (a11) indicates the frequency of the received signal.

b. TYPE MR-15A CRANK DRIVE.—The crank (b1) rotates the crank drive which rotates the loop and the azimuth indicator pointer (d1) or (e1).

c. TYPE IN-4A LEFT-RIGHT INDICATOR.—The functions of the controls are as follows:

(1) ON-COURSE.—When the pointer (c3) is on the small figure of an airplane (c1) and the azimuth indicator pointer (d1) or (e1) is on 0, the aircraft is heading toward the transmitting station. When the pointer (c3) indicates on-course (c1) the plane of the loop is perpendicular to the transmitter (except for distortion) and the azimuth indicator pointer (d1) or (e1) indicates the direction, relative to the line-of-flight of the incoming signal.

(2) RIGHT INDICATION.—When the pointer (c3) is on or near the right indicator (c2) the transmitter is to the right of the aircraft [with pointer (d1) or (e1) on 0] or to the right of the heading (or bearing) indicated by the pointer (d1) or (e1). (See fig. 28.)

(3) POINTER.—The pointer (c3) indicates the approximate direction of the incoming signals relative to the perpendicular plane of the loop. (See fig. 28.)

(4) LEFT INDICATION.—The left indicator (c4) gives an indication opposite of that which the right indication (c2) gives. (See fig. 28 and subparagraph c. (2) above.)

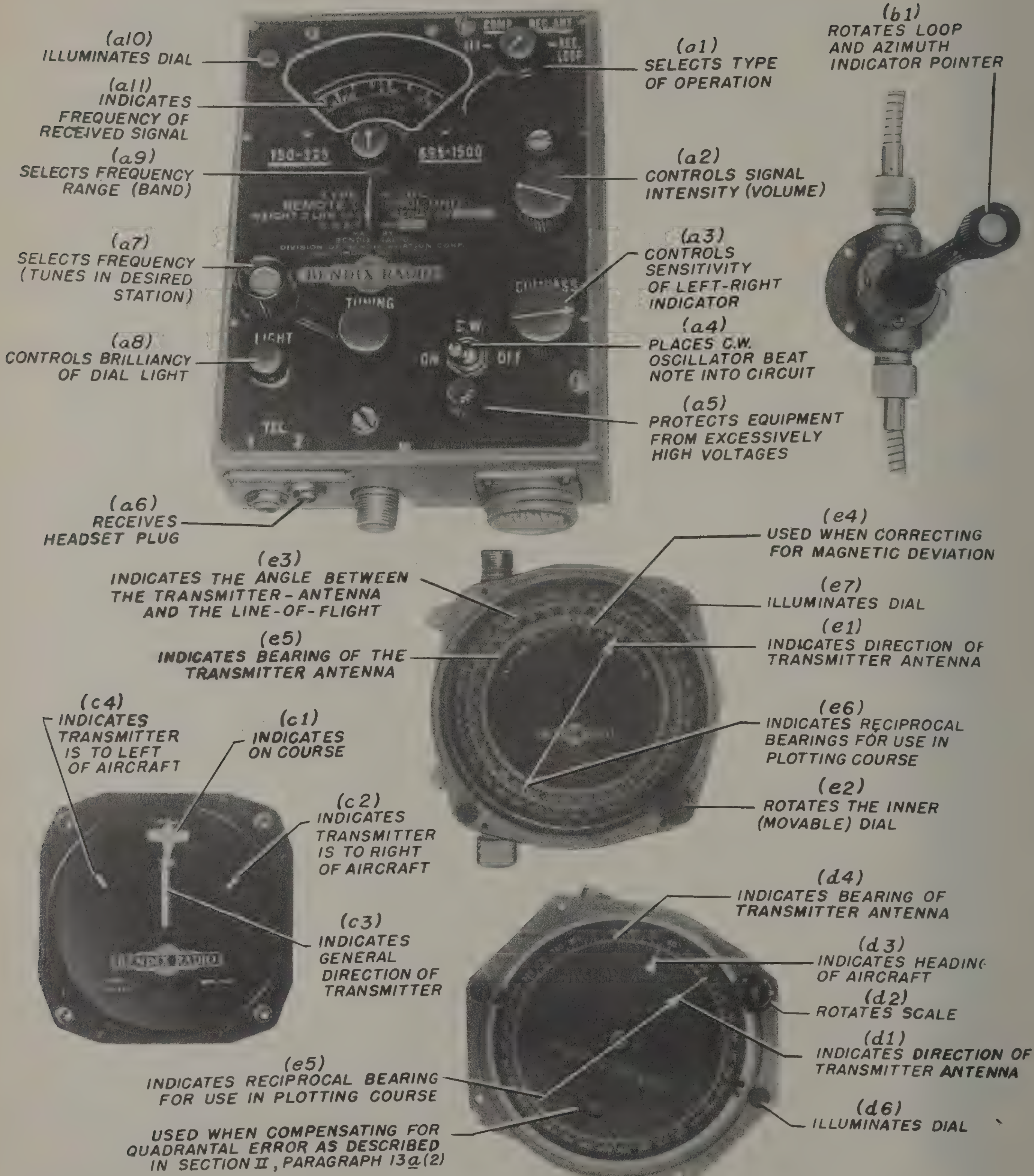


Figure 28—Function of Controls

d. TYPE MN-40D AZIMUTH INDICATOR.—The functions of the controls are as follows:

(1) POINTER.—The pointer (d1) indicates the direction of the transmitter antenna.

(2) "VAR." KNOB.—This knob (d2) rotates the scale (d4).

(3) INDEX MARK.—The index mark (d3) indicates the heading of the aircraft. Rotate the "VAR." knob (d2) until the true bearing (relative to true north) is indicated on the scale (d4) opposite the index mark (d3).

(4) SCALE.—The scale (d4) indicates the bearing of the transmitter antenna when the azimuth indicator has been corrected for quadrantal error (sec. II, par. 7a). If the index mark (d3) is opposite zero on the scale (d4) the pointer (d1) indicates the aircraft-to-transmitter bearing. If the index mark (d3) is opposite the true bearing of the aircraft-heading on the scale (d4) the pointer (d1) will indicate the bearing (relative to true north) of the transmitter antenna.

(5) TAIL END.—The tail end (d5) of the pointer (d1) indicates the reciprocal bearing of the transmitter antenna. The bearing, on the scale (d4) at this point, is used in plotting the position and course of the aircraft.

e. TYPE MN-22A AZIMUTH INDICATOR.—The functions of the controls are as follows:

(1) POINTER.—The pointer (e1) indicates the direction of the transmitter antenna.

(2) KNOB.—The knob (e2) rotates the inner scale (e5).

(3) OUTER (FIXED) SCALE.—The outer scale (e3) indicates the bearing between the transmitter antenna and aircraft line of flight at the arrow end of the pointer (e1).

(4) EAST-WEST-VARIATION SCALE.—The variation scale (e4) indicates the variation of the magnetic north to the true north. The use of this scale is described below.

(5) INNER (MOVABLE) SCALE.—The inner scale (e5) indicates the bearing (relative to north) of the transmitter antenna after the dial (e5) has been set to bearing of the aircraft. The inner dial (e5) is rotated by means of the knob (e2) until the magnetic bearing of the aircraft is indicated on the inner scale (e5) opposite the zero (0) on the outer scale (e3) or east-west variation scale (e4). The scale (e5) is corrected for magnetic deviation by first noting the number on the inner scale (e5) opposite the variation scale (e4), then rotating knob (e2) until this number is opposite the known east or west magnetic deviation for the locality on the variation scale (e4).

(6) TAIL END.—The tail end (e6) of the pointer (e1) indicates the reciprocal bearing of the transmitter antenna. After the inner scale (e5) has been set for the bearing of the aircraft, the bearing indicated on the inner scale (e5) under the tail end (e6) of pointer (e1) is used in plotting the position and course of the aircraft.

2. COMMUNCATIONS RECEPTION. (See Fig. 28.)

a. GENERAL.—The Type MN-26* Radio Compass may be used for normal reception of communications using a fixed antenna or, in times of extreme rain or snow static conditions, the loop antenna may be used in place of the vertical antenna for anti-static reception. Anti-static reception is not used at all times because of the lower over-all sensitivity when using the loop only.

b. NORMAL RECEPTION (ANTENNA).

(1) Turn function switch (a1)* to "REC. ANT."

(2) Select desired frequency range (a9).

(3) Snap "C.W." switch (a4) "ON" or "OFF" as desired.

(4) Tune in station (a7)

(5) Adjust "AUDIO" control (a2) for desired headset volume.

The "COMPASS" control (a3) is not used for reception of communications.

c. ANTI-RAIN-STATIC RECEPTION (LOOP). The operation procedure is as follows: (Bands I and II only in Types MN-26M and MN-26Y Radio Compasses):

(1) Turn function switch (a1) to "REC. LOOP."

(2) Select desired frequency range (a9).

(3) Snap "C.W." switch (a4) "ON" or "OFF" as desired.

(4) Tune in station (a7).

(5) Rotate crank drive (b1) for maximum output in headset.

(6) If the station is to the left or right of the airplane's course, it will occasionally be necessary to readjust the azimuth control setting (b1) for maximum signal.

(7) Adjust "AUDIO" control for desired headset volume.

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* Letter and figure references refer to parts of paragraph 1 which describe the control or operation.

3. HOMING. (See Fig. 30.)

a. RADIO RANGE RECEPTION.—For this type of reception it is necessary to have a map showing the radio range course and characteristics, or to know the location of the course and its characteristic A and N signal areas. The operating procedure is as follows:

(1) Turn function switch to "REC. ANT."

(2) Turn band switch (a9) to Band I (150-325 or 200-410).

(3) Tune "TUNING" crank to desired frequency.

(4) Adjust "AUDIO" control to desired signal level.

(5) Obtain a fix position (see sec. III, par. 4d) to determine the direction to the course it is desired to follow.

(6) Turn plane so as to intercept the radio range course.

(7) The A and N signals will blend into a continuous dash interrupted by the station identification when on course.

(8) The plane may then be flown on course to the location of the radio range station.

(9) Arrival at destination is indicated by an abrupt decrease in headset volume known as the cone of silence.

(10) A radio range course may also be flown with anti-rain-static reception (Bands I and II only in Types MN-26Y and MN-26M Radio Compasses) in which case set the function switch (a1) on "REC LOOP" and rotate the crank drive (b1) for maximum signal strength at approximately 90-degree (d4 or e3) or 270-degree (b1 or e3) settings.

b. VISUAL RADIO COMPASS HOMING.—The operating procedure is as follows:

(1) Set azimuth indicator (d4 or e3) at zero.

(2) Adjust "COMPASS" control (a3) to maximum.

(3) Turn function switch to "COMP."

(4) Select desired frequency range (a9) and tune in station (a7).

(5) Listen carefully for station identification to be sure that the desired station is being received. "AUDIO" control (a2) may be set for any audio output level without affecting the deflection of the left-right indicator needle.

(6) Alter the airplane's course to left or right as shown by the left-right indicator needle (c3) until reading is zero or on course (c1).

(7) Although on-course indications (c1) will be obtained both when approaching and when flying away from a transmitter (see figure 31) no confusion as to location of the station need result. If a course correction, to the right for example, is accompanied by a deflection of the indicating needle in the same direction, (c2), the station is aft, while if the deflection is in the opposite direction, (c4), the station is ahead. The compass indicator needle points in the general direction of the transmitting station.

(8) Reduce "COMPASS" control setting until an intermediate value has been found which permits following the course accurately without continuous hunting.

c. AURAL NULL HOMING.—Aural null homing may be used in place of visual radio compass homing if any of the compass circuits or indicator are inoperative or if there is severe rain static. This method is not as desirable as radio compass homing because of the possibility of 180 degrees ambiguity of direction. The operation procedure is as follows:

(1) Turn function switch (a1) to "REC. LOOP."

(2) Select desired frequency range (a9) and tune in station (a7).

(3) Listen carefully for station identification.

(4) When homing on weak signals, turn "C.W." switch (a4) "ON."

(5) Adjust "AUDIO" control (a2) for the desired audio level.

(6) Rotate crank drive (b1) for zero reading on the azimuth indicator (d3 or e3).

(7) Turn airplane until headphone volume decreases to minimum.

(8) Fly plane on this null course until desired position has been reached.

4. DIRECTION FINDING. (See Fig. 28.)

a. VISUAL BEARINGS.—To obtain radio compass bearings when using Type MN-40D Azimuth Indicator proceed as follows:

(1) Turn function switch (a1) to "COMP."

(2) Adjust "COMPASS" control (a3) for desired sensitivity of the left-right indicator.

(3) Select frequency range (a9) and tune in desired station (a7). Check station identification to be sure of having correct station.

(4) Use the "VAR." knob (d2) to set the bearing scale (d4) so that the numerical value of the aircraft's magnetic heading is at the index mark (d3).

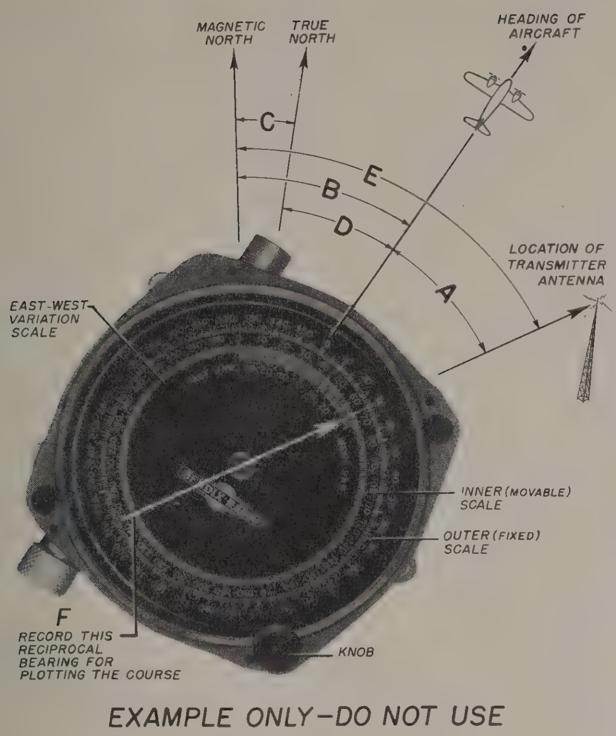


Figure 29—Type MN-22A Azimuth Indicator, Function of Scales

(5) Determine the magnetic variation for the locality. Rotate "VAR." knob (d2) for the required correction in the direction indicated by the knob's arrows. This knob (d2) is marked with arrows to show the proper direction of rotation to compensate for East or West variation. (This is not necessary when obtaining a "fix").

(6) Rotate crank drive (b1) until the compass needle (c3) is at the center position (c1). If the needle points to the right (c2), rotate the crank drive for an increasing azimuth indicator reading (d4), and if the needle points to the left (c4), rotate the crank drive for a decreasing reading (d4). Another method is to watch the indicator needle while rotating the crank (b1). Turn the crank for clockwise rotation of the azimuth indicator pointer (d1); if the compass needle moves left, the correct bearing is being taken. If the compass needle moves right, rotate the azimuth-indicator pointer 180 degrees.

(7) When the compass needle indicates on-course (c1), record the reading of scale under the tail end of the pointer (d1). The arrow end of the pointer indicates the magnetic bearing from the aircraft to the transmitting antenna while the tail end (d5) of the pointer indicates the magnetic bearing from the transmitting antenna to the aircraft and this bearing is used for plotting the location and course of the aircraft. (For explanation, see par. 4e, this section.)

b. AURAL-NULL METHOD WITH TYPE MN-40D AZIMUTH INDICATOR.—To obtain radio compass bearing by the aural null method when using Type MN-40D Azimuth Indicator proceed as follows:

(1) Turn function switch (a1) to "REC. LOOP."

(2) Select frequency range (a9) and tune in desired station (a7). When listening for station identification it may be necessary to obtain a good intelligible signal to rotate the loop (b1) to a maximum signal position.

(3) Adjust "AUDIO" control (a2) for desired headset level.

(4) Rotate "VAR." knob (d2) until the magnetic heading of the aircraft is at the index mark (d3) on the scale (d4).

(5) Determine the magnetic variation for the locality, and rotate the "VAR." knob for the required correction. (This is not necessary when obtaining a "fix".)

(6) Rotate the crank drive until a sharp decrease is noticed in the headset volume. If the signal exists over too wide an angle, obtain greater accuracy by setting the "AUDIO" control (a2) on maximum, and locating null by either listening for the disappearance of the audio signal, or by noting the dip (left deflection) in the tuning meter deflection.

(7) Record the reading of the scale (d4) at the tail end (d5) of the pointer (d1). Bearings are subject to 180-degree ambiguity but this will not matter when plotting the position of the aircraft if bearings are taken on two or more stations.

c. VISUAL BEARINGS WITH TYPE MN-22A AZIMUTH INDICATOR. (See figs. 28, 29 and 30.)—To obtain radio compass bearings when using Type MN-22A Azimuth Indicator proceed as follows:

(1) Turn function switch (a1) to "COMP."

(2) Adjust "COMPASS" control (a3) for desired sensitivity of the left-right indicator.

(3) Select frequency range (a9) and tune in desired station (a7). Check station identification to be sure of having correct station.

(4) Rotate the knob until the numerical value of the aircraft magnetic heading is indicated on the inner scale (e5) opposite the zero (0) on the outer scale (e3). (Illustrated as angle "B" in fig. 29.)

(5) Determine the magnetic variation for the locality in which the aircraft is located. Note the

number on the inner scale (e5) opposite the zero (0) on the east-west variation scale (e4), and rotate knob (e2) until this number on the inner scale is opposite the number of degrees variation (east or west) on the variation scale (e4). (This is not necessary when obtaining a "fix".)

(6) Rotate the crank drive until the compass needle indicates on-course (c1).

(7) The pointer now indicates the following:

(a) The relative bearing between the aircraft's line-of-flight and the transmitting antenna on the outer scale at the arrow end of the pointer. (Angle "A" of fig. 29.)

(b) The bearing of the transmitting antenna relative to magnetic north on the inner scale at the arrow end of the pointer. (Angle "E" of fig. 29.)

(c) The reciprocal 4th bearing of the transmitting antenna is read on the inner scale at the tail end of the pointer. This is used for locating the aircraft and plotting the course.

d. AURAL-NULL METHOD WITH TYPE MN-22A AZIMUTH INDICATOR. (See figs. 28, 29 and 30.)—To obtain radio compass bearings by the aural-null method when using Type MN-22A Azimuth Indicator proceed as follows:

(1) Turn function switch to "REC. LOOP."

(2) Select frequency range (a9) and tune in desired station (a7). When listening for station identification it may be necessary to rotate the crank drive (b1) for maximum signal strength.

(3) Adjust "AUDIO" control for desired volume.

(4) Rotate the "VAR." knob until the magnetic heading of the aircraft is indicated on the inner scale at the zero (0) on the outer scale. (Par. 4d (5) below is not necessary when obtaining a "fix".) (This is angle "B" of fig. 29.)

(5) Determine the magnetic variations for the locality. Rotate the "VAR." knob until the number on the inner scale (e5) [at the zero (0) on the variation scale (e4)] is located opposite the number of degrees variation on the variation scale. (This variation is shown by angle "C" in fig. 29.)

(6) Rotate the crank drive until the compass needle indicates on-course (e1).

(7) Record the reading of the inner scale (e5) at the tail end (e6) of the pointer (e1). (This is "F" in fig. 29.) This value is used in plotting the course of the aircraft as described in paragraph 4 below. This bearing is subject to 180 degrees ambiguity.

e. PLOTTING LOCATION AND COURSE OF AIRCRAFT. (See figs. 29 and 30.)

(1) GENERAL.—The location of the aircraft at a given time may be determined by plotting the radio bearings obtained from two or more known radio stations. The intersection of the plotted bearings is the location of the aircraft at the time the bearings were obtained, provided, of course, that the bearings are not in error, and that the elapsed time from one radio bearing to the next is small enough so that the distance travelled by the aircraft may be neglected. A third radio bearing is usually obtained as a check on the first two. The three bearings may intersect at one point but generally form a small triangle at their intersection. A comparatively large triangle obtained by plotting three bearings indicates that at least one of the bearings may be in error or that too much time has elapsed between successive bearings. In cases where appreciable movement of the aircraft has occurred between radio bearings, the approximate locations of the aircraft at the time each bearing was taken may be obtained by a simple graphical solution. A line is shifted on the map or chart, parallel to the heading of the aircraft, until the distances between the plotted bearings on this line correspond in order to the scale distances covered by the aircraft between consecutive bearings. This assumes that all bearings are equally accurate and that a uniform speed and direction of flight has been maintained during the time the bearings have been taken.

Either true bearings or magnetic bearings may be used for a position fix. In the example given below, the use of magnetic bearings and headings will be assumed since practically all aerial navigation is based on the magnetic compass. The use of charts similar to the "Radio Direction Finder Charts for Aeronautical Use", prepared by the U. S. Coast and Geodetic Survey is also assumed. These direction finder charts have magnetic compass roses centered on the radio stations so that magnetic bearings may be easily plotted with a straight edge.

Two or preferably three known radio stations providing usable signals are chosen prior to the time the fix is to be obtained. Their frequencies or dial positions are noted in increasing or decreasing order so that tuning from one station to the next may be accomplished in a minimum of time. Cage the directional gyro to a corrected magnetic compass reading and hold the aircraft as close as possible to this magnetic course. The heading must be held constant while the bearings are being taken. Then rotate the azimuth scale of the radio bearing indicator until the zero index indicates the magnetic heading of the aircraft so that bearings referred to Magnetic North may be read directly from the azimuth scale. Tune in the radio station with the highest (or lowest) frequency or dial on the radio compass. Rotate the crank until the left-right indicator needle is at center, then note the reading of the bearing indicator for this radio station. Tune the radio compass immediately to the second radio station, so that the radio bearing for that station

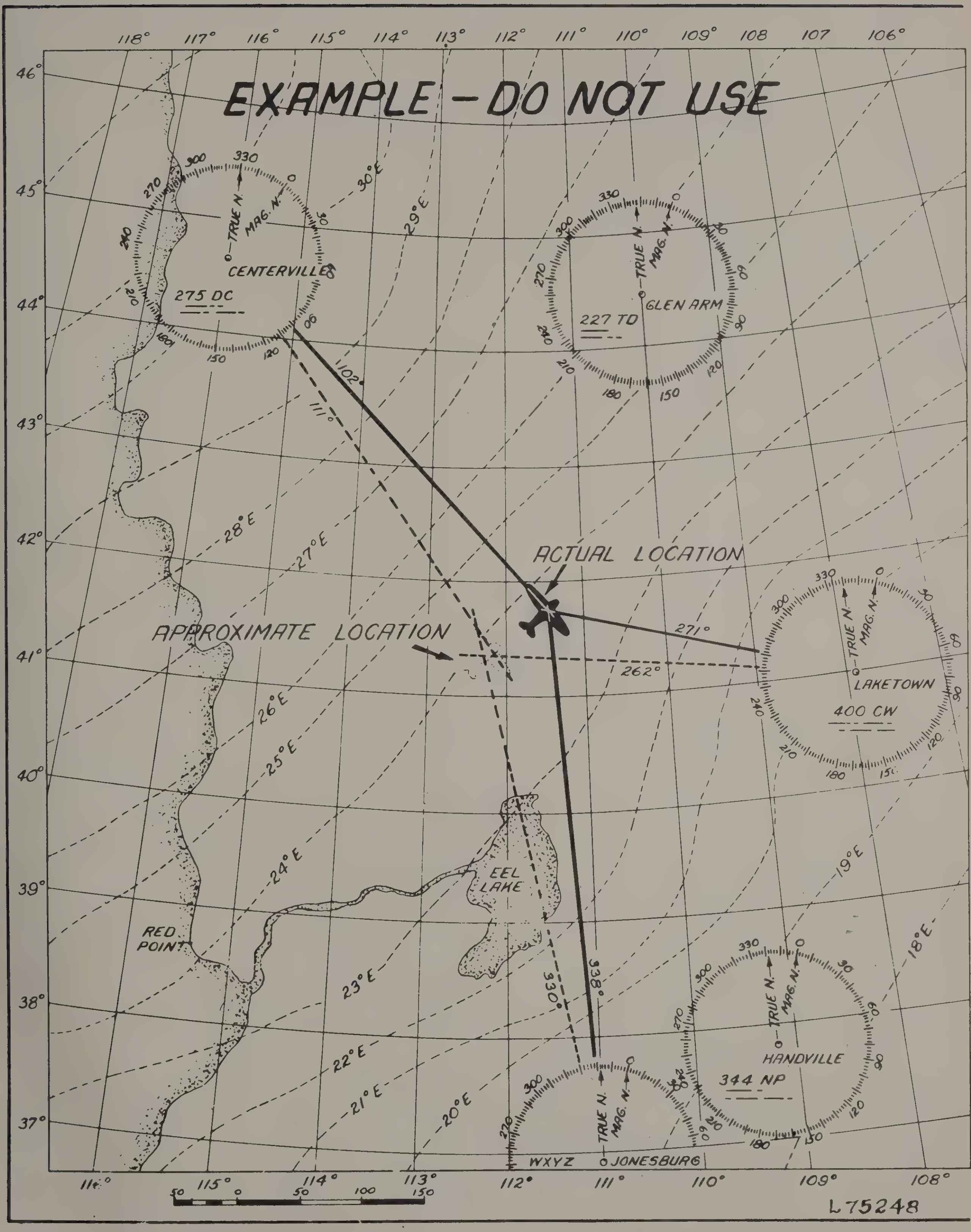


Figure 30—Plotting Location and Course of Aircraft

may be obtained. Tune in the third radio station and take a third reading of the bearing indicator.

The three radio bearings obtained are magnetic bearings from the aircraft to the respective radio stations. Since the position of the aircraft is unknown, the bearings must be plotted from the radio stations. The approximate location of the aircraft is spotted on the D/F chart either by dead reckoning or by plotting the reciprocal radio bearings from the known radio stations. An accurate location is then determined by correcting the radio bearings for meridian convergence of the chart and for the difference in magnetic variation at the aircraft and location of the radio station.

(2) EXAMPLE OF PLOTTING LOCATION.—A location problem of this nature is shown in figure 30 For example, suppose the magnetic bearing from the aircraft may be 262 degrees to station "CW" at "Laketown", 330 degrees to "WXYZ" at "Jonesburg," and 111 degrees to "DC" at "Centerville." Plotting the reciprocals of these bearings results in a triangle, the center of which is the approximate location of the aircraft. Examination of the D F chart (figure 30) shows that a correction for meridian convergence of about 4 degrees (112-108-4) must be added to the bearing for station "CW." since the aircraft is west of the radio station. The magnetic variation is 20 degrees east at station "CW," and 25 degrees east at the location of the aircraft; therefore the difference in magnetic variation of 5 degrees (25-20-5) must be added to the bearing, since the variation is greater easterly at the aircraft than at the radio station. A value of 268 degrees is obtained after these corrections have been applied, which is the true reciprocal of the magnetic bearing from station "CW" to the aircraft. These corrections for the three radio stations are listed in the following tables.

The meridian convergence corrections are as follows:

Radio Station	*Meridian (Approximate)*		*Meridian Correction*
	At Station	*At Aircraft*	
CW	108°	112°	+4°
WXYZ	111°	112°	+1°
DC	116°	112°	–4°

The magnetic deviation corrections are as follows:

Radio Station	*Magnetic Deviation (Approximate)*		*Magnetic Deviation Correction*
	At Station	*At Aircraft*	
CW	20° E	25° E	+5°
WXYZ	18° E	25° E	+7°
DC	30° E	25° E	–5°

The total corrections are as follows:

Radio Station	*Meridian Correction*	*Magnetic Correction*	*Total Correction*
CW	+4°	+5°	+9°
WXYZ	–1°	+7°	+8°
DC	–4°	–5°	–9°

The true bearings from the radio stations to the aircraft are as follows:

Radio Stations	*Bearing (From Azimuth Indicator)*	*Total Correction*	*True Beaing (After Correction)*
CW	262°	+9°	271°
WXYZ	330°	+8°	338°
DC	111°	–9°	102°

When the bearings are plotted on the D/F chart the actual location of the aircraft is the intersection of the three lines, as illustrated in figure 33.

f. DIRECTION FINDING PRECAUTIONS.

(1) When only the pilot is present, set the bearing indicator pointer to zero index prior to take-off.

(2) No provision is made for "COMP." operation on Band III in the types MN-26M and MN-26Y radio compass.

(3) Select radio stations providing stable bearings. Tune equipment carefully. If an interfering signal is heard in the headset, it is probably the cause of an error in bearing. To check, tune a few kilocycles either side of maximum. A change in bearing with tuning indicates an interfering signal. Hold the compass indicator needle on course during this test and note any change in bearing on the directional gyro. If it is not desirable to change the course of the aircraft, the loop drive may be rotated to recenter the compass indicator. If station interference exists, select another station, or proceed by other means of navigation until closer to the desired station. Be careful when taking bearings from stations broadcasting the same program as they may be mistaken for each other. Avoid taking bearings on synchronized stations unless close to the desired station. If the radio station stops transmitting or fades, especially a station operating on a network, bearings may have been taken on other stations of the same frequency (tuning dial setting), and thus cause errors.

(4) Check dial calibrations against actual station frequencies.

(5) Do not operate with "COMPASS" control on maximum as the radio compass will be very sensitive to the least wobbling of the aircraft. Reduce "COMPASS" control until 15-degree loop rotation produces full scale deflection of the left-right indicator.

(6) Do not depend on the tuning meter as a distance meter.

(7) Do not disturb any internal adjustments.

(8) Night effect, or reflection of radio waves from the sky, is always present and is worse at sunrise and sunset. It may be recognized by a fluctuation in bearing. Try the following procedures to eliminate night effect:

(a) Increase altitude, thereby increasing the strength of the direct wave.

(b) Take an average of the fluctuations.

(c) Select a lower frequency station.

Night effect is present on stations at 1500 kc at distances greater than 20 miles. As the frequency decreases, the distance increases until at 200 kc the distance will be about 200 miles. Satisfactory bearings, however, will often be obtained at much greater distances.

(9) When close to a station, accurate bearings cannot be taken with the aircraft in a steep bank. This is especially applicable to reception of signals from instrument landing trucks.

(10) Only head-on bearings are entirely dependable. When side bearings are taken, keep the wings horizontal.

(11) Do not depend upon two stations for a fix of location; but **use at least three station bearings.** In general, a set of bearings spaced at approximately equal intervals throughout 360 degrees will give test accuracy.

(12) This equipment provides compass bearings during conditions of moderate precipitation static which interrupts normal reception. To avoid the type of precipitation static which exists in air mass fronts at different temperatures, cross the air mass front at right angles and then proceed on the desired course instead of flying along the air mass front.

SECTION IV

MECHANICAL AND ELECTRICAL CHARACTERISTICS

1. THEORY OF RADIO COMPASS OPERATION.

a. GENERAL.—In addition to its use as a radio communication receiver, Type MN-26* Radio Compass may be used to guide aircraft to the transmitting station at its destination, or it may be used to take bearings on transmitting stations as an aid to navigation. When the equipment is used as a radio compass, the pilot and navigator can also hear station signals and can obtain weather reports or other flight information.

When the pilot wishes to fly the aircraft toward a transmitting station, that is, to use the equipment as a homing radio compass, the receiver is switched to "COMP." operation and the station tuned in. A rotatable loop set with the azimuth scale in the zero position, provides directional characteristics. The volume ("AUDIO") control and the indicator sensitivity ("COMPASS") control are then adjusted, and the aircraft turned until the (left-right) indicator points to the center.

The compass indicator will remain at the center as long as the aircraft is headed directly toward, or directly away from, the transmitter (see fig. 31), however, the behavior of the indicator will determine whether the transmitter is ahead of, or behind the aircraft.

If the transmitter is ahead and the aircraft is turned from the true course, the compass indicator will deviate from center. That is, when there is any departure from the true course the pilot can visualize the transmitter as being located on the side indicated by the pointer (see fig. 31.) Turning the aircraft in that direction will bring it back on course and the indicator back on center.

If the transmitter is behind the aircraft, the deviation is opposite. That is, if the indicator deviates from center and the aircraft is turned in the direction indicated by the indicator, the deviation will increase, and the pointer will not return to center until the aircraft is turned through 180 degrees, and is again headed toward the transmitter.

The indicator does not measure the course deviation in degrees. However, the indication is proportional to the deviation, and shows upon which side of the line of flight the transmitter is located, and remains on center only when the transmitter is in line with the axis of the aircraft. The sensitivity of the compass indication is adjustable.

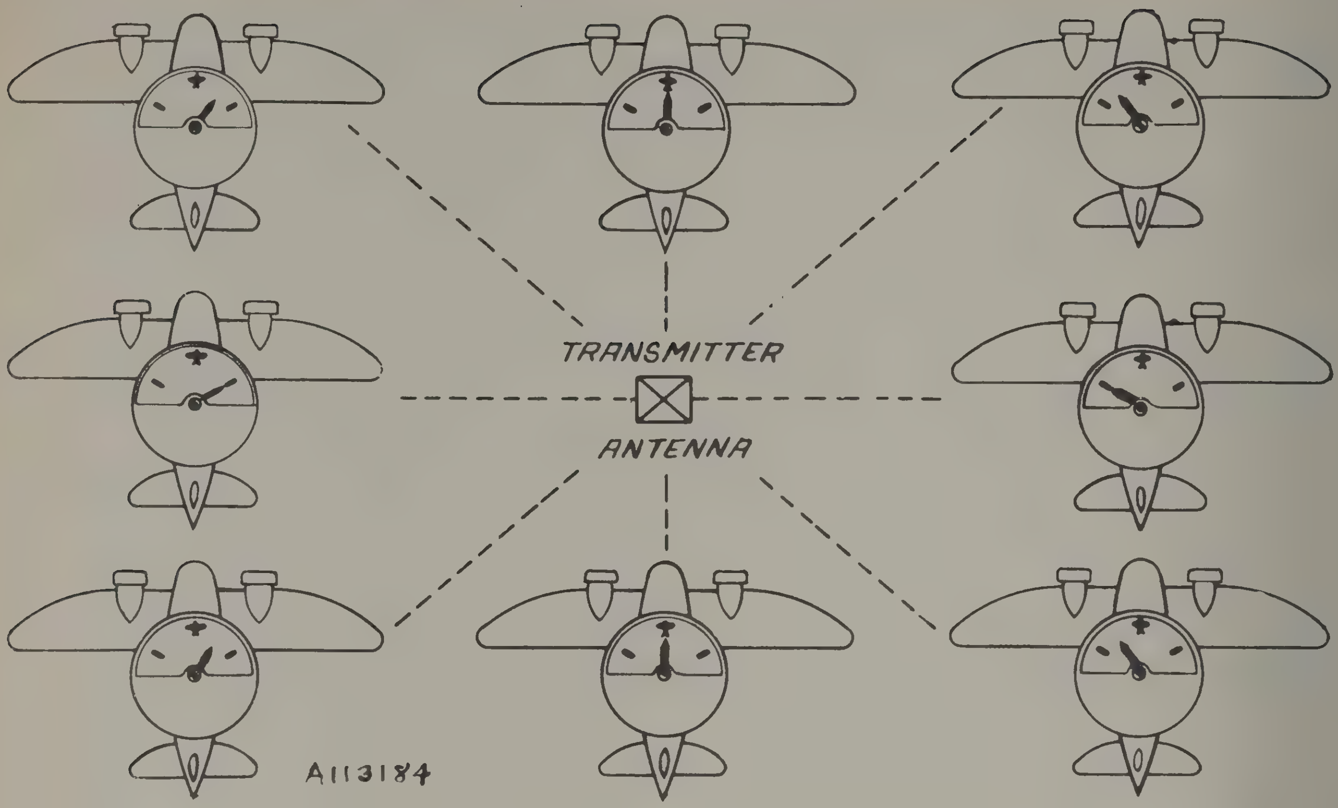


Figure 31—Type IN-4A Left-Right Indicator, Functional Diagram

If the navigator wishes to take a bearing upon a transmitter, the loop is rotated until the compass indicator points to center, in which case the bearing of the transmitter with respect to the axis of the aircraft is shown on the azimuth indicator dial. The bearings of several transmitting stations may be taken in this manner to definitely establish the position of the aircraft. When bearings are thus taken, the equipment functions as a radio direction finder.

b. FUNCTION OF COMPONENTS OF TYPE MN-26* RADIO COMPASS.—This Radio Compass consists of a loop antenna, a loop input and amplifier, a 90-degree phase shifter, a balanced modulator, an audio oscillator, a non-directional antenna, a sensitive and selective receiver, a compass indictor, and a telephone output circuit. (See fig. 32.) The vertical antenna is non-directional, or is equally sensitive to radio signals from any direction. The voltage induced in a vertical antenna is in phase with the magnetic flux of the radio wave.

The loop antenna is directional in that the voltage induced in the loop is maximum when an edge of the loop is turned toward the transmitter, and is zero when the plane of the loop is perpendicular to the direction of travel of the radio wave from the transmitter. The resultant voltage induced in the loop is 90 degrees out of phase with the voltage induced in the vertical antenna, and changes abruptly 180 degrees, as the loop is rotated through the position of zero pick-up.

The voltage from the loop is amplified and shifted through 90 degrees so that it is either in phase with (0 degrees), or in phase opposition to (180 degrees) the voltage induced in the vertical antenna, depending upon which edge of the loop is turned toward the transmitter. (See figs. 33 and 34.)

The voltage from the loop amplifier is then impressed upon the grids of the balanced modulator tube, which is actually two triodes combined into a single unit. The grids of the modulator tube are driven in phase opposition by the audio oscillator so that only one of the triode sections passes the loop signal at a time. Since the plates of the modulator tube are push-pull connected to the receiver circuits, they alternately add to, and subtract from, the voltage contributed by the vertical antenna. The addition of the loop signal to the signal from the non-directional antenna reverses in phase as the loop is rotated through a null position. The audio oscillator also provides the alternating current for the field of the dynamometer-type compass indicator. (See figs. 33 and 34.)

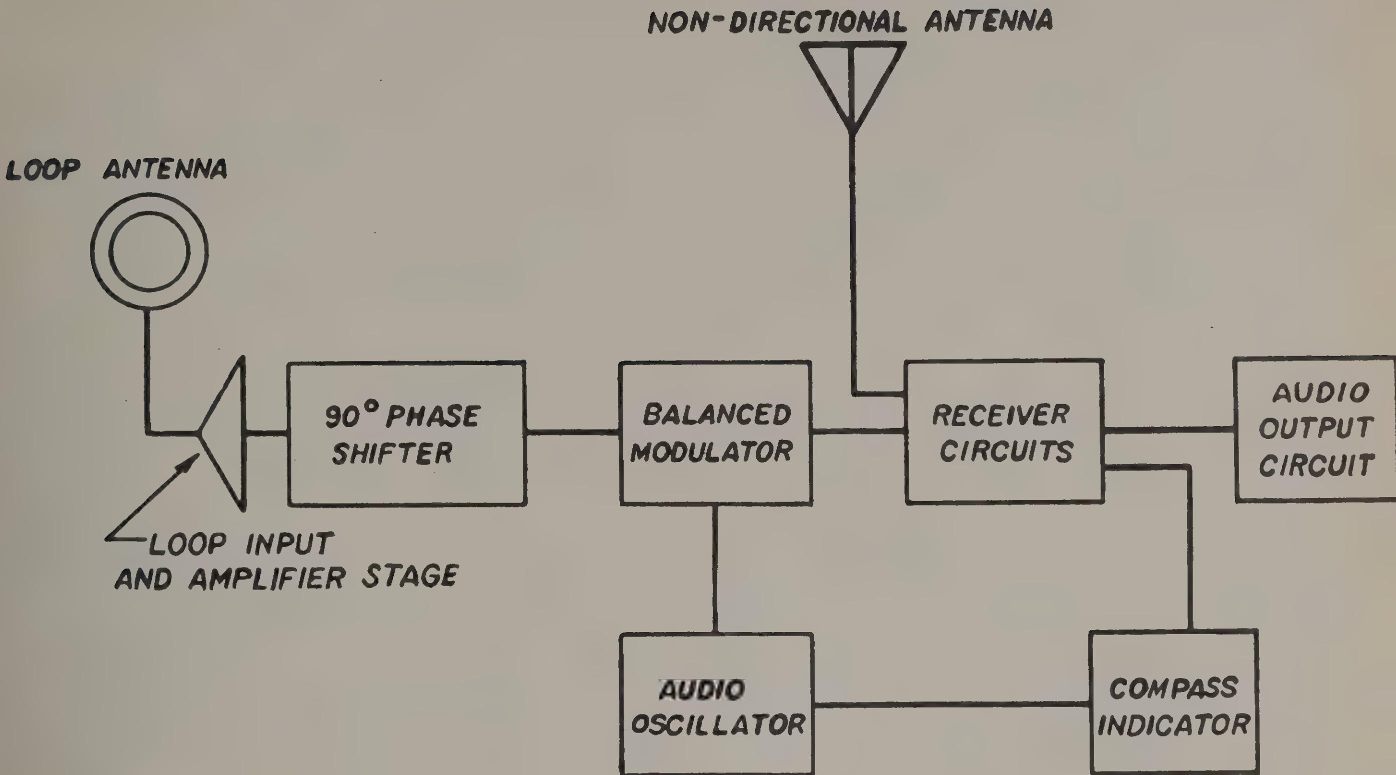


Figure 32—Type MN-26 Radio Compass, Block Diagram of Circuit Functions*

c. CIRCUITS.—The receiver circuit amplifies the combined signal, which is modulated at the audio oscillator frequency proportionally to the voltage contributed by the loop; moreover, the phase of the modulation reverses as the loop is rotated through a null. The modulated signal is then detected, amplified, and impressed upon the moving coil of the compass indicator. (See figs. 33 and 35.)

The compass circuits are arranged so that if the radio signal is coming from the left, the modulation is such that the compass indicator pointer turns to the left; and if the radio signal is from the right, the compass indicator pointer turns to the right. (See figs. 33 and 34.) When the signal source is on a line perpendicular to the plane of the loop, the loop voltage is zero and there is no modulation of the carrier at the frequency of the audio oscillator causing the compass indicator pointer to remain at center. To follow the operation of the various compass elements refer to the simplified compass circuit, figure 33.

The voltage induced in the loop by a radio wave from the transmitter is coupled to the loop amplifier tube V1 through transformer T1 (when operating on Band I) or T2 (when operating on Band II). The parallel combination of L1 and C38 (in the plate circuit of V1) has a capacitive reactance at the signal frequency, so that the phase of the signal voltage is shifted 90 degrees (see figs. 33 and 34) when impressed upon the grids of modulator tube V3 through capacitors C19-1 and C19-2.

The fixed coil of the dynamometer-type compass indicator is tuned to resonance at 48-cycles-per-second, and serves as the tuned circuit of audio oscillator tube V2. Since the compass indicator has an alternating magnetic field of 48-cycles-per-second, current in the moving coil at the same frequency, and in phase, will produce a deflection of the pointer toward the right of the center. If the phase of the current in the moving coil is reversed the deflection of the pointer will also reverse. Voltage from the audio oscillator is impressed upon the grids of the modulator tube sections in phase opposition through resistors R12-10, R12-11, R12-6 and R12-7 and capacitors C3-18 and C3-19. Due to its characteristics and because of the magnitude of the audio oscillator voltage impressed upon its grids, modulator tube V3 functions as an electronic switch, permitting the loop voltage to pass through first one section, and then the other. Since the plates of the modulator tube are push-pull connected to transformer T4 (when operating on Band I) or T5

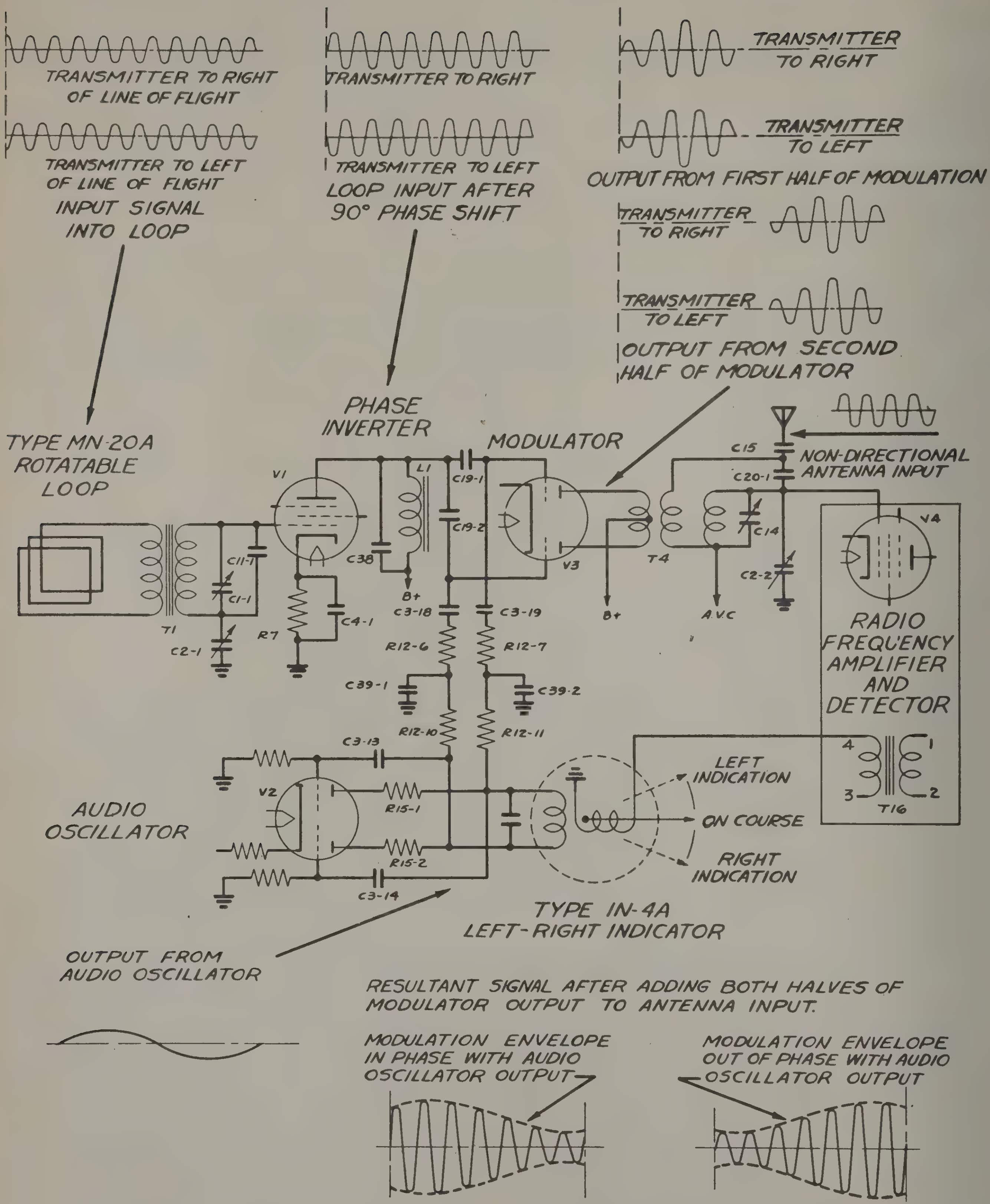


Figure 33—Type MN-26 Radio Compass, Simplified Schematic, Compass Operation*

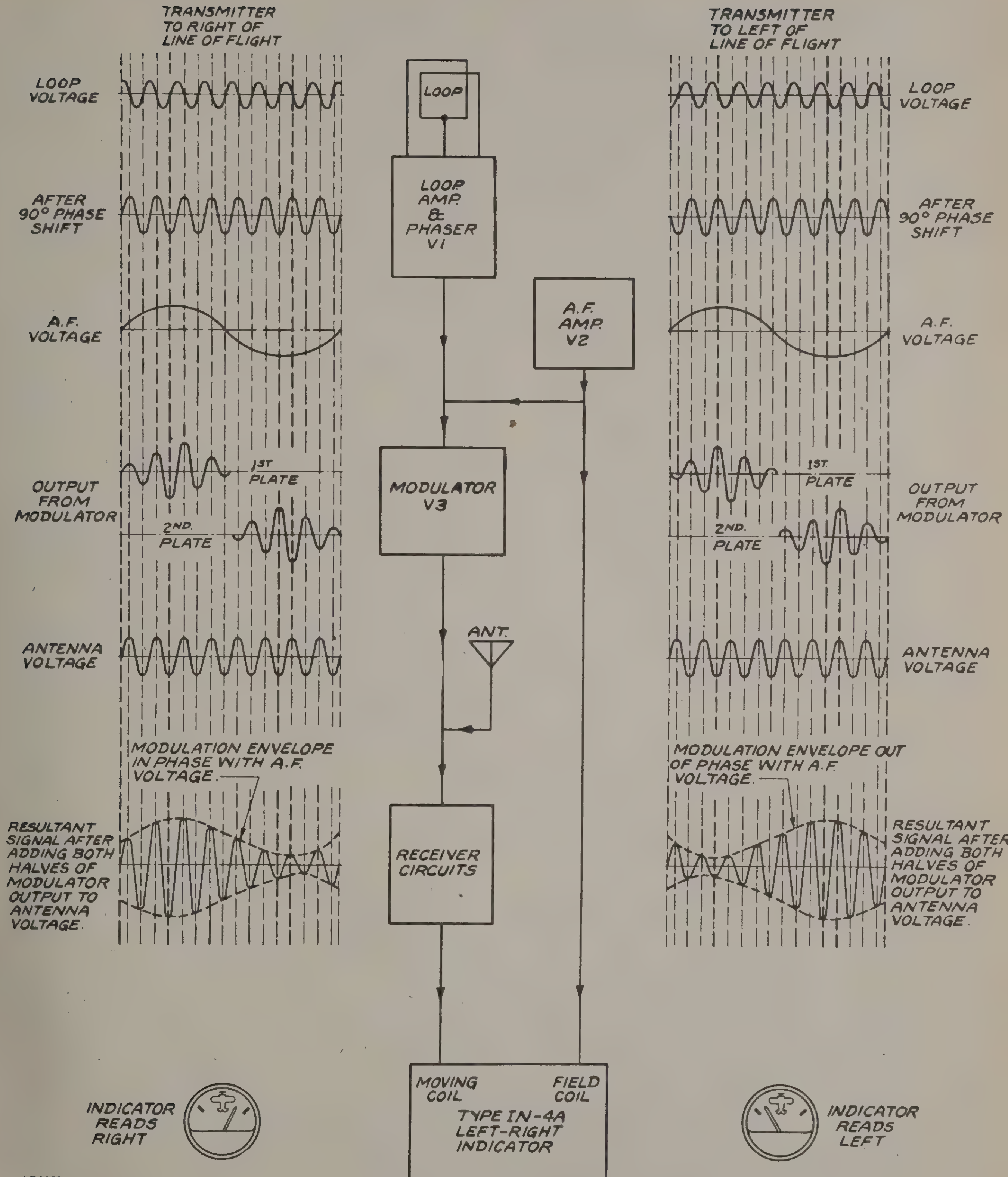


Figure 34—Functional Diagram, Development of Modulation Envelope

(when operating on Band II), the amplified loop voltage is added to the non-directional antenna voltage when one section of the modulator tube is functioning, and subtracted when the other section is functioning. The received signal is thus locally modulated at the frequency of the audio oscillator proportional to the voltage induced in the loop.

The signal is then amplified and the local modulation is detected and amplified to provide 48-cycle-per-second energy for the moving coil of the compass indicator. The phase of the voltage induced in the loop and the phase of the local modulation are reversed as the loop is rotated through a null. This in turn reverses the phase of the current in the moving coil of the compass indicator, and changes the deflection of the pointer from one side of center to the other.

Figures 33 and 34 show the phase of the voltages acting in the modulator circuit for reception from the right and left. When the transmitter is located on the axis of the loop, there is no voltage induced and consequently no local modulation of the received signal.

2. DETAILED DESCRIPTION OF PRINCIPAL COMPONENTS

a. TYPE MN-26* RADIO COMPASS.

(1) MECHANICAL.—Type MN-26* Radio Compass includes a cabinet, chassis, and mounting base. It also includes one set of vacuum tubes, one $^6\!/_{32}$ socket type setscrew wrench, and five grid shield caps.

The cabinet, formed of aluminum sheet and finished in gray wrinkle enamel, is dust and spray proof. Slides in the base of the cabinet permit easy withdrawal of the chassis, which is held securely in place by a captive through-bolt running from the front panel of the chassis to a riveted nut in the back of the cabinet.

The mounting base consists of an aluminum base plate, with rubber shock absorbers mounted in the four corners.

The chassis of the radio compass receiver contains the compass circuit elements, the superheterodyne receiver circuit elements, and the high voltage power supply. It is formed of welded aluminum and is constructed so that when servicing the unit it may be placed on any of five sides without damage. A panel containing all of the cable terminations is attached to the front end. All circuits are shielded so that after the equipment is aligned, the chassis may be placed in the cabinet without changing the alignments. The setscrew wrench is clipped to the middle chassis cross member. For maintenance purpose, the sub-assemblies and other components on and under the chassis deck are arranged to provide the optimum in accessibility.

(2) ELECTRICAL.—Type MN-26* Radio Compass comprises a compass circuit and a receiver circuit. The receiver may be operated with either a loop antenna or a non-directional antenna on Bands I and II (some models also use a loop antenna on Band III, but with a non-directional antenna only on Band III. The frequency range is covered in three bands as follows:

Radio Compass Type	*Band I (Kilocycles)*	*Band II (Kilocycles)*	*Band III (Kilocycles)*
MN-26A	150-325	325-695	695-1500
MN-26C	150-325	325-695	695-1500
MN-26CA	150-325	325-695	695-1500
MN-26M	200-410	410-850	3400-7000
MN-26W	200-410	410-850	850-1750
MN-26Y	150-325	325-695	3400-7000

Band selection is accomplished by a motor-driven band switch. Sections of the switch insert into each circuit the coils for the desired band and short out all unused coils, thereby preventing any resonant absorption circuits. The receiver circuit is of the superheterodyne type and consists of three stages of tuned radio-frequency amplification (including first detector), a radio-frequency oscillator and intermediate-frequency amplifiers, a second detector and audio amplifier, an avc circuit, an audio output amplifier, a compass output tube, and a c-w beat frequency oscillator. (Refer to figs. 51 to 54.) While the following circuit description traces only the circuit for Band I, it is applicable to other bands by substituting the appropriate coils for those bands.

The non-directional vertical antenna connects to relay RE1, which performs two functions: (1) when operating the set on "COMP." or "REC. ANT.," the non-directional antenna connects directly through the relay contacts to the primary of T4, the antenna input transformer; (2) when on "REC. LOOP," the relay connections are arranged to ground the non-directional antenna and to substitute capacitor C21-1 across the antenna primary winding of T4, the antenna input transformer. Resistor R18 connects directly to the antenna and permits electrostatic charges to leak off to ground when the antenna is not grounded. Capacitor C15 prevents damage to the antenna transformer when a d-c voltage is applied to the antenna. The primaries of T4 are inductively coupled to the secondary which is tuned by the second section of the ganged tuning capacitor C2-2. The grid of the 1st r-f tube connects to the secondary of the transformer. A small neon tube between the grid

and ground protects tube and circuit elements against high antenna voltages which may result from operation of the airplane's transmitter or from high electrostatic charges on the antenna.

A coil in the cathode lead is resonated at 110.5 kc by capacitor C14-1 and acts as a trap circuit to attenuate unwanted signals near the intermediate frequency.

The plate of the first r-f tube couples through transformer T7-1 to the grid of the second r-f tube, the secondary of transformer T7-1 being tuned by the third section of the ganged tuning capacitor C2-3. An i-f trap circuit L3, C14-2, in the cathode lead of the second r-f tube, is tuned to 114.5 kc. The plate of this tube connects to the primary of transformer T7-2, the secondary of which is tuned by the fourth section of the ganged tuning capacitor C2-4, and connects to the control grid of V6, the third r-f or first detector tube.

The injector grid of the first detector is excited by the output of triode oscillator tube V7 which is tuned 112.5 kc above the desired signal by the fifth section of ganged tuning capacitor C2-5. The plate circuit of this detector tube is tuned to 112.5 kc, and couples inductively to the control of i-f tube V8.

The plate circuit of i-f amplifier tube V8 is tuned to 112.5 kc and is coupled inductively to a second tuned circuit, which connects to one diode rectifier plate of the second detector tube.

Output from the c-w beat frequency oscillator V9 is coupled to the above mentioned diode plate. Operation of tube V9 is controlled by S10, a toggle switch (C. W. "ON-OFF") located on the remote control unit.

The grid of the second detector tube V10 receives the audio component of the rectified radio frequency signal at the junction of the diode load resistors R14-5 and R28.

The second diode plate is fed from the plate circuit of the i-f tube through capacitor C21-4, and supplies avc bias for tubes V4, V5, V6, and V8.

The greater the amplitude of the received signal, the greater will be the voltage built up across avc load resistor R22-4 by the rectified carrier. Since the control grids of the preceding tubes are connected to the negative end of the resistor, negative bias on them will be increased by a strong carrier, and because of their variable amplification characteristics, they will operate at reduced gain on such signals. Conversely, on weak signals the bias introduced by the avc will be smaller and the tubes will operate at higher gain. This action tends, therefore, to maintain incoming signals at a constant level. The avc circuit operates only when the master switch is set at "COMP."

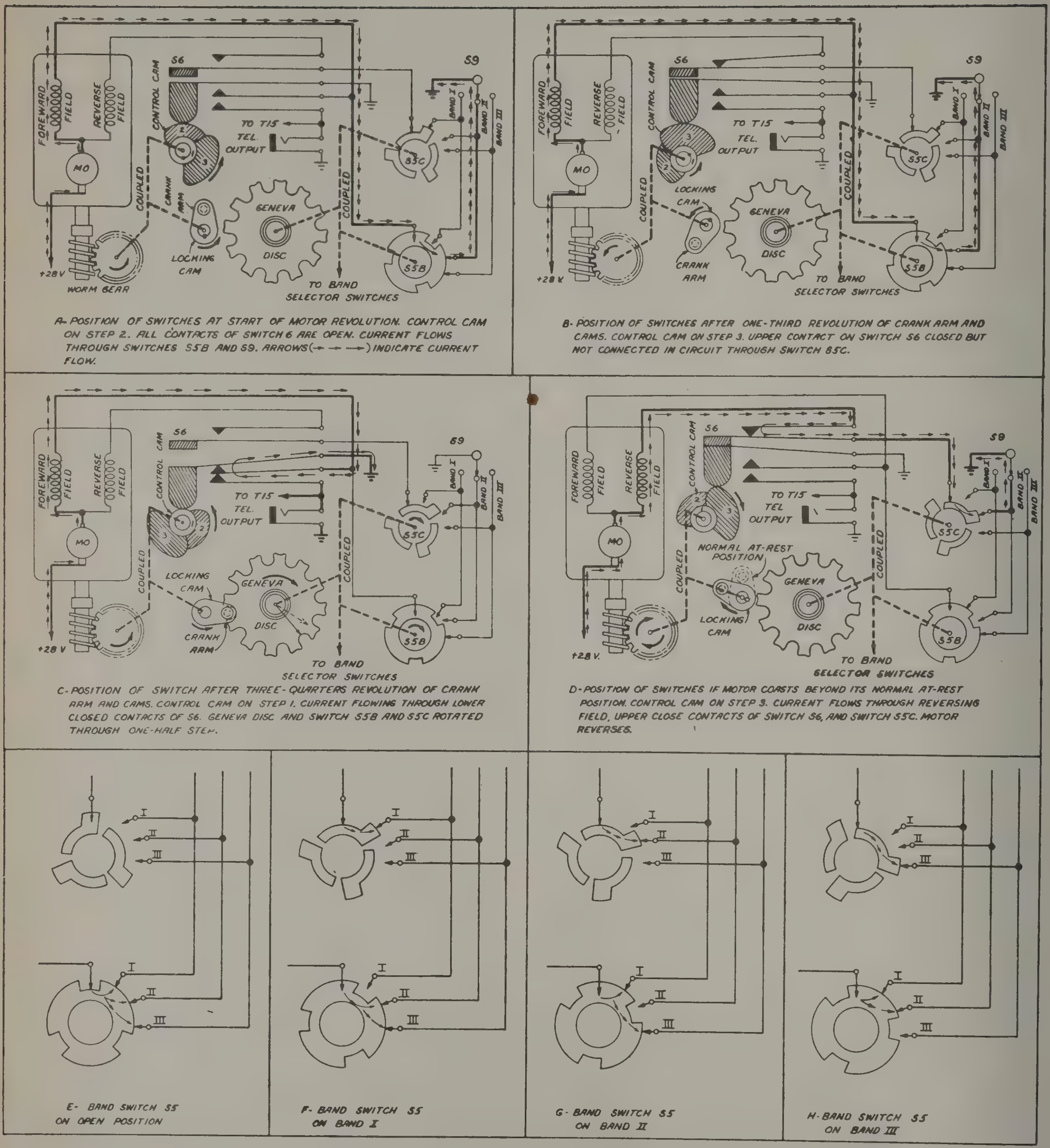
The plate of the second detector tube is resistance-capacitance coupled to the grid of the audio output tube V11. The plate of this output tube is connected to the primary of output transformer T15. The secondary of this transformer is tapped for connection to 600-ohm or 4000-ohm output circuits. The output of transformer T15 is connected to the headset jacks J1 and J2.

(3) BAND CHANGE CIRCUIT. — Band changing is affected by switching the tuned circuits in the "LOOP," "ANTENNA," "RADIO FREQ.-1," "RADIO FREQ.-2" and "OSCILLATOR" stages by means of motor-driven switches.

The motor armature drives a worm gear, ganged to a common shaft with the crank arm and locking cam, and the control cam. (See fig. 35A.) The crank arm drives the geneva disc which is ganged on a second common shaft with positioning switches S5B and S5C (see fig. 35C), and with the band selector switches. The control cam operates switch S6.

When the remote control unit band selector switch is operated to select a different band, band switch motor MO is energized by completion of the circuit to ground through the contacts of switches S9 and S5B. (See fig. 35A.) The motor drives the crank arm through one, two, or three complete revolutions (see fig. 35C) which steps the geneva disc a notch at a time until the motor is deenergized. Figure 35A illustrates the positions of these controls when the band changing is complete, except that switch S9 would be on another contact and no current would be flowing.

Exact control of the position is obtained by the control-cam-operated switch S6. When the motor is at rest, the arm of switch S6 is on step 2 of the control cam, and all contacts are open. When the motor starts, the arm is first raised by step 3 of the cam (position as in fig. 35B), closing the upper contacts, which at this time perform no function since the circuit between S5C and S9 is open. As the motor continues operating, the arm of S6 will drop down to step 1 of the cam (see fig. 35C), opening the upper contacts and closing the lower ones. Closing the lower contacts provides an additional path to ground to keep the motor energized after the opening of S5B by the movement of the geneva disc, and also grounds the audio output of the radio compass to prevent "clicks" while changing bands (see fig. 35C). When the crank arm has been driven past the geneva disc, engaging the locking cam with the arc of the disc, the control cam raises the arm of the S6 to step 2, opening all contacts, and the motor coasts to a stop. If it should coast past step 2, the upper contacts of S6 will be closed by the control cam and will now energize the reverse field of the motor through the contacts of S5C and S9 (see fig. 35D), and the



A- POSITION OF SWITCHES AT START OF MOTOR REVOLUTION. CONTROL CAM ON STEP 2. ALL CONTACTS OF SWITCH 6 ARE OPEN. CURRENT FLOWS THROUGH SWITCHES S5B AND S9. ARROWS(→ → →) INDICATE CURRENT FLOW.

B- POSITION OF SWITCHES AFTER ONE-THIRD REVOLUTION OF CRANK ARM AND CAMS. CONTROL CAM ON STEP 3. UPPER CONTACT ON SWITCH S6 CLOSED BUT NOT CONNECTED IN CIRCUIT THROUGH SWITCH S5C.

C- POSITION OF SWITCH AFTER THREE-QUARTERS REVOLUTION OF CRANK ARM AND CAMS. CONTROL CAM ON STEP 1. CURRENT FLOWING THROUGH LOWER CLOSED CONTACTS OF S6. GENEVA DISC AND SWITCH S5B AND S5C ROTATED THROUGH ONE-HALF STEP.

D- POSITION OF SWITCHES IF MOTOR COASTS BEYOND ITS NORMAL AT-REST POSITION. CONTROL CAM ON STEP 3. CURRENT FLOWS THROUGH REVERSING FIELD, UPPER CLOSE CONTACTS OF SWITCH S6, AND SWITCH S5C. MOTOR REVERSES.

E- BAND SWITCH S5 ON OPEN POSITION

F- BAND SWITCH S5 ON BAND I

G- BAND SWITCH S5 ON BAND II

H- BAND SWITCH S5 ON BAND III

Figure 35—Functional Diagram, Band Switch Motor Operation

motor will reverse to the proper position until all contacts of S6 are open.

The number of revolutions required by the crank arm will depend upon the relative positions of switches S5B, S5C, and S9 at the start of motor revolutions, because the switch S5 moves in only one direction (see figs. 35E, 35F, 35G, and 35H). If the switches are at rest on Band III (see fig. 35H) and switch S9 is placed on Band II, the switch will have to advance three places (figs. 35E, 35F, and 35G) before the motor will again stop. If, however, the switches are at rest on Band II (see fig. 35G) and switch S9 is placed on Band III, the switch need only advance one step (see fig. 35H) to open the motor contacts.

(4) SIDETONE CIRCUITS.—A portion of the audio voltage from a transmitter may be fed to the audio input circuit of the radio compass for purposes of monitoring transmissions.

Relay RE2 is connected into the grid circuit of the audio amplifier tube V11 to allow input from either the receiver circuits or the transmitter sidetone circuits. The unoperated position of the relay provides continuity of the output circuits. The operated position of the relay grounds the avc buss and connects the externally applied (approximately 1.5 volts) voltage to audio amplifier tube V11. Voltage for operation of the relay solenoid is obtained from the radio compass primary voltage and is controlled by connecting the transmitter push-to-talk switch to the negative and positive sidetone leads. All connections to the sidetone relay circuit are to be made on the connector board.

b. TYPE MN-28 REMOTE CONTROL. (See figs. 36, 37, and 38.)

(1) MECHANICAL FEATURES.—The three bands are calibrated on one dial. Bands not in use are covered by a mask. This mask is attached to the switch which selects the band. The dial is calibrated as in the table below.

DIAL CALIBRATION OF REMOTE CONTROL

Type	*Band*	*Calibration*
MN-28C and MN-28G	I	Every 5 kc from 150 to 325 kc
	II	Every 10 kc from 325 to 695 kc
	III	Every 10 kc from 695 to 1500 kc
MN-28NA	I	Every 5 kc from 200 to 410 kc
	II	Every 10 kc from 410 to 850 kc
	III	Every .05 mc from 3.4 to 7.0 mc
MN-28X	I	Every 5 kc from 200 to 410 kc
	II	Every 10 kc from 410 to 850 kc
	III	Every 10 kc from 850 to 1750 kc
MN-28Y	I	Every 5 kc from 150 to 325 kc
	II	Every 10 kc from 325 to 695 kc
	III	Every .05 mc from 3.4 to 7.0 mc

(2) ELECTRICAL CHARACTERISTICS.—Type MN-28 Remote Control electrically controls the operation of Type MN-26* Radio Compass. The controls function as follows:

(a) FUNCTION SWITCH. (See fig. 36.)—When in the "OFF" position, switch S8A opens the circuit between the 28-volt primary power source and the circuit components of the radio compass equipment, and operation ceases. When in the "COMP." position switch S8B places resistor R27 into the cathode circuit of the audio oscillator tube V2 which causes this tube to operate; switch S8D places "COMPASS" control R2 into the cathode

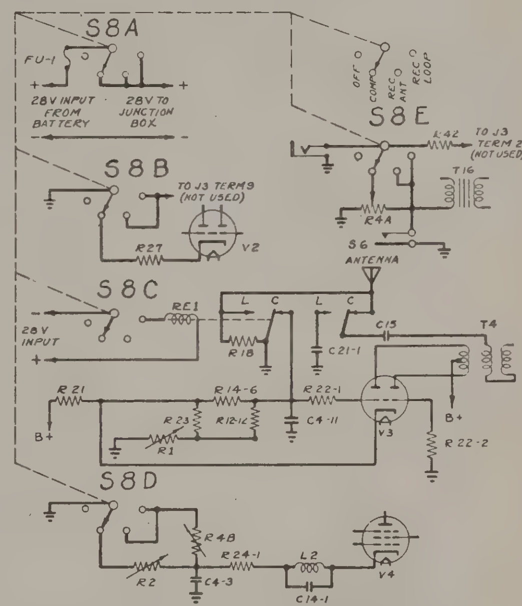


Figure 36—Functional Diagram, Function Switch S8

of the first r-f tube V4 permitting control of the threshold sensitivity; and switch S8E places section R4A of the "AUDIO" control between output transformer T16 and the "TEL." jacks, to control the audio level. When in the "REC. ANT." position, switch S8D places section R4B of the "AUDIO" control in the cathode circuit of tube V4 in place of R2, and switch S8E places output transformer T16 directly into the "TEL." jack in place of section R4A of the audio control. When in the "REC. LOOP" position, switches S8D and S8E perform the same functions as when in the "REC. ANT." position and in the "REC. LOOP" position, switch S8C operates relay RE1. Relay RE1 removes the antenna from the receiver elements and grounds it, and opens the ground connection from the junction of resistors R22-1 and R14-6 causing one side of the tube V3 to become inoperative. Tube V3 functions as a balanced modulator with switch S8 in the

NOTES:

A-SNAP SWITCH COUPLED TO SHAFT OF S8. "OFF" IN POSITION 1, "ON" IN ALL OTHER POSITIONS OF S8.

B-FOR 14 VOLT OPERATION, A JUMPER (SHOWN BY A BROKEN LINE) MUST BE ACROSS SECTION "B" OF RESISTOR R35-3.

C-IN TYPES MN-28G AND MN-28X, RESISTOR R42 IS NOT USED AND TERMINAL "2" IS CONNECTED TO JACKS J1 AND J2.

D-THE FOLLOWING TABLE LISTS THE VALUES OF RESISTORS R4A AND R42:

REMOTE CONTROL TYPE	RESISTANCE (OHMS)	
	R4A	R42
MN-28A	2000	NOT USED
MN-28C	2000	250
MN-28G	25,000	NOT USED
MN-28NA	2000	250
MN-28X	2000	NOT USED
MN-28Y	2000	250

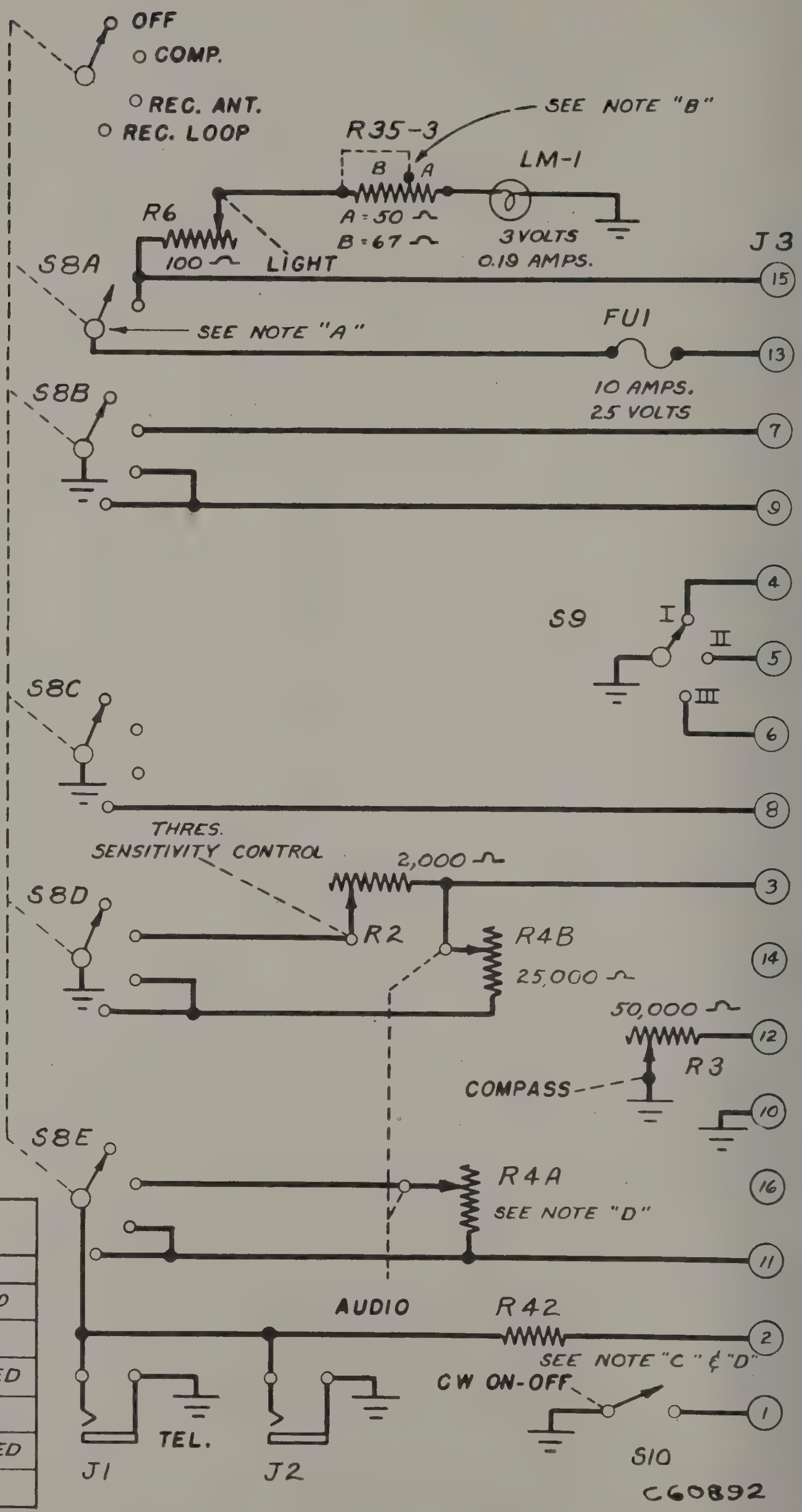


Figure 37—Type MN-28 Remote Control, Schematic Circuit Diagram

"COMP." position, as a triode amplifier in the "REC. LOOP" position, and is inoperative in the "REC. ANT." position.

(b) BAND SWITCH.—The operation of the band selector switch S9 is described in paragraph 2a (3), this section.

(c) "AUDIO" CONTROL.—This control regulates the level of the audio signal in the headset. This control is a dual potentiometer (R4A and 4B) connected in the headset and r-f amplifier cathode circuits. When functioning as a compass (function switch S8 on "COMP."), the equipment is operating on automatic volume control and by varying this control section R4A determines the audio level (or volume) in the headset. When the equipment is operating as a receiver (function switch on "REC. ANT." or "REC. LOOP") this control (section R4B) varies the gain of the r-f amplifiers, permitting radio range reception.

(d) THRESHOLD SENSITIVITY CONTROL.—This control is welded on the back of "COMPASS" control R3, and it is accessible only by removal of the base of the remote control. At the time of installation the function switch is placed on "COMP." and the threshold sensitivity control R2 is adjusted to limit the gain of the r-f amplifiers to prevent erratic fluctuation of Type IN-4A Left-Right Indicator due to noise. Instructions for setting this control are described in section II, paragraph 5.

(e) "COMPASS" CONTROL.—This control R3 regulates the extent of pointer deflection of Type IN-4A Left-Right Indicator by varying the gain of the compass output tube V12. Resistors R3 and R19-1 provide grid bias for tube V12.

(3) COMPARISON OF REMOTE CONTROLS.—The following table lists the differences between the various remote controls which may be used with the MN-26* radio compasses described in this book.

Besides the physical differences shown in the preceding table, there are slight differences in wiring as follows: (1) In types MN-28C, MN-28NA, and MN-28Y, the audio output terminal 2 is connected through the resistor R42 to jacks J1 and J2; (2) types MN-28G, and MN-28X are similar to types MN-28C, MN-28NA, and MN-28Y except that resistor R42 is eliminated and terminal 2 is directly connected to jacks J1 and J2. (See figs. 3 and 37.)

The remote controls may be used with either 14 or 28 volt sources by connection or removal of the jumper across section B of resistor R35-3.

c. TYPE IN-4A LEFT-RIGHT INDICATOR. (See figs. 7 and 39.)—The indicator is an iron-core dynamometer type meter which indicates the direction of incoming radio waves with respect to the plane of the loop antenna. When correctly interconnected to other components of MN-26* radio compass equipment, the center-tapped field coil serves as the plate inductance for the 48-cycle audio oscillator tube V2, being resonated by a capacitor mounted inside the case. As shown in figure 39, terminals 2 and 4 of the receptacle connect to the moving coil and terminals 1, 3, and 5 connect to the field coil.

As shown in figure 39, connect the field resonating meter load assembly (AA18823-1) into the junction box across terminals 3 and 5 of plug P5.

d. TYPES MN-20 AND MN-24 ROTATABLE LOOPS.—The loop consists of a center-tapped coil of wire enclosed in an electrostatic shield. It is capable of being rotated from a remote point. All connections from the loop coil are made through slip rings through brushes which are connected to the loop transmission cable receptacle.

The differences between the various models available for this equipment are as follows:

(1) TYPE MN-20 ROTATABLE LOOP.—The diameter of the loop is nine inches and the loop is equipped with a right angle drive fitting. Placing the loop drive fitting into one of the openings in the loop base adapts the loop for mounting on the top of the aircraft while placing the fitting in the other opening adapts the loop for mounting under the aircraft. A cover plate is provided for covering whichever opening is not used.

Type Number	*Output Impedance*	*Resistance (Ohms)*		*Frequency Range*
		R4A	*R42*	
MN-28C	600Ω	2000	250	150-1500 kc
MN-28G	4000Ω	25,000	Not Used	150-1500 kc
MN-28NA	600Ω	2000	250	200- 850 kc and 3.4- 7.0 mc
MN-28X	600Ω	2000	Not Used	200-1750 kc
MN-28Y	600Ω	200	250	150- 695 kc and 3.4- 7.0 mc

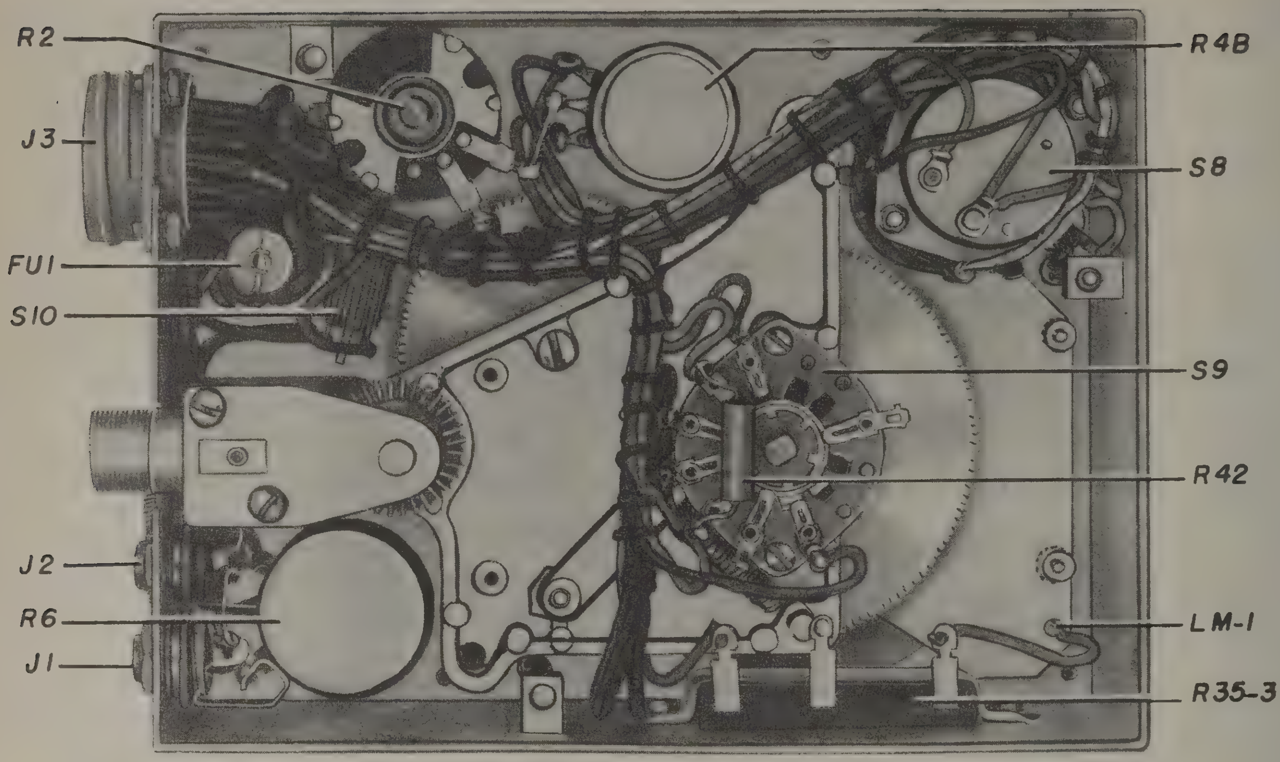


Figure 38—Type MN-28 Remote Control, Interior View

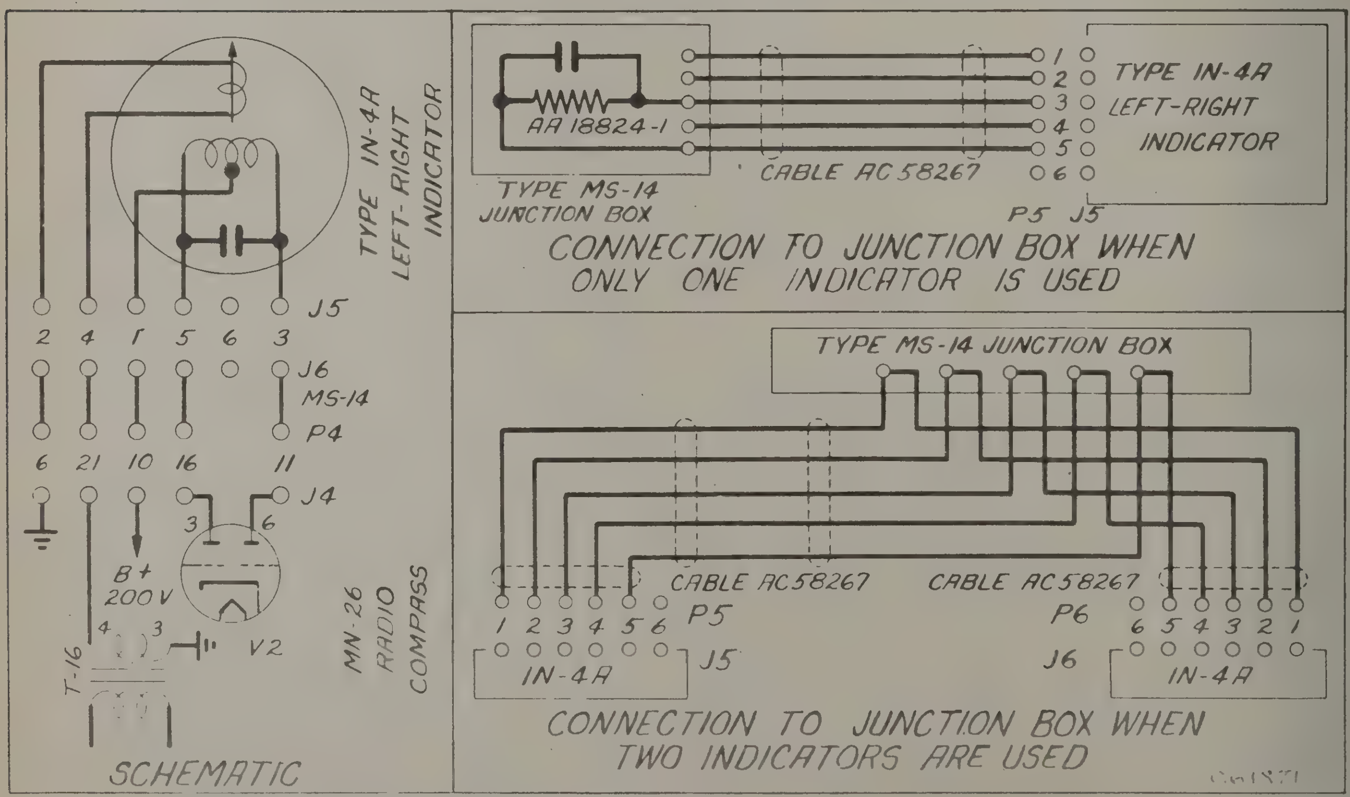


Figure 39—Type IN-4A Left-Right Indicator, Schematic Circuit Diagram

(2) TYPE MN-20C ROTATABLE LOOP.—The Type MN-20C loop is identical to Type MN-20A except that it has a straight fitting in place of a right angle fitting.

(3) TYPE MN-20E ROTATABLE LOOP.—The MN-20E loop is similar to loop MN-20C except that it has two-straight-type loop drive fittings which simplify installation. The Type MB-52A Right Angle Drive may be used to permit right angle approach of the mechanical cable.

(4) TYPE MN-24A ROTATABLE LOOP.—Loop Type MN-24A is similar to Type MN-20A except that the loop diameter is 18 inches.

(5) TYPE MN-24B ROTATABLE LOOP.—Type MN-24B loop is similar to the loop MN-20C except that the loop diameter is 18 inches.

(6) TYPE MN-24C ROTATABLE LOOP.—Loop type MN-24C is similar to loop MN-20E except that the loop diameter is 18 inches.

e. TYPES MN-22A AND MN-40D AZIMUTH INDICATOR.—Essentially these indicators consist of double ended tach-shaft drives to which are connected, through an appropriate gear and cam drive, a pointer that moves in a horizontal plane against the indicator dial. They are designed for use with standard aircraft tachometer shafts (AA15410-1) and with any loop that has a gear drive reduction of 120:1 between loop and tach-shaft.

Two instrument lamps provide illumination. These lamps are connected in parallel with one side grounded, and require a 3-volt, 0.38 d-c source.

The azimuth indicators are equipped with compensator which, when properly adjusted, permit reading the true bearing of the source of the received signal.

(1) TYPE MN-40D AZIMUTH INDICATOR.—A cam strip is located in the cam housing assembly. This strip, provided with an adjusting screw (through the cam housing assembly) at each 15 degrees around its periphery, controls the compensator, which automatically applies the aircraft error correction to the indicator pointer. The scale, which is visible through the small opening in the lower center of the indicator face, is used as a reference scale when the aircraft error compensators are being adjusted.

The heading of the aircraft relative to magnetic North, and any necessary East or West variation correction is applied by moving the azimuth scale the proper number of degrees relative to the fixed index mark by means of the variation knob.

(2) TYPE MN-22A AZIMUTH INDICATOR.—Connected to the internal gearing is a circular cam scribed with 9 circles and 24 radial lines corresponding to degrees correction and degrees azimuth rotation respectively. The cam can be cut to any required shape to meet the particular installation and can accommodate a maximum error of plus or minus 20 degrees. As supplied the cam introduces no correction and be used, if no error correction is required, without further adjustment.

This Azimuth Control provides means for obtaining loop rotation and bearings (indications of loop settings corrected for quadrantal error) as follows:

(a) Bearings relative to airplane's heading are read on the outer fixed dial.

(b) Magnetic bearings are read under the pointer on the inner movable dial, after the number on this dial, which corresponds to the airplane's magnetic course, has been set at the zero mark on the fixed dials.

(c) True bearings are read under the pointer on the movable dial after the number on this dial, which corresponds to the airplane's magnetic course, has been set opposite the east or west compass variation shown on the inner fixed dial.

(d) Reciprocal bearings can be read at the opposite end of the pointer.

SECTION V
MAINTENANCE

1. ROUTINE INSPECTIONS.

a. PRE-FLIGHT INSPECTIONS.—Make regular inspections preceding each flight as follows:

(1) Inspect all interconnecting cables to see that they are securely locked in their receptacles.

(2) Check airplane battery with a hydrometer.

(3) Check operation of the voltage regulator on the charging generator, adjusting same to insure consistent operation of the generators at 28 to 30 volts.

(4) Clean antenna insulators, especially any which may be exposed to engine exhaust or propeller blast.

(5) Check connections of lead-in wires, both at antenna and radio compass ends.

(6) Check all instrument lamps.

(7) If radio compass is functioning properly with power supply "background noise" at a suitable low level, do not disturb the power supply unit.

(8) For each inspection, include a listening test made on at least one point in each band. Check operation of all controls. Any major trouble should be apparent from these tests.

b. PERIODIC INSPECTIONS.—APPLICABLE TO ALL PARTS.—Inspect all nuts, bolts, and screws for looseness. Do not tighten or loosen glyptalled screws or nuts unless it is evident they are loose. In the event they are, remove screws or nuts, glyptal, replace and tighten. Remove loose solder, dirt, and metallic chips. Clean equipment thoroughly and touch up scratched paint. Inspect soldered joints. Inspect wiring. Inspect all plug connectors and clean if necessary.

c. TYPE MN-26* RADIO COMPASS.—Inspect unit as described in paragraph 1, this section, but do not disturb alignment adjustment. Do not disturb wiring unless necessary. Check all tubes. If the tube plate current is less than 80% of normal plate current with 6.3 volts on heater, replace the tubes. Replace all tubes used over 500 hours.

(1) DYNAMOTOR UNIT.—Inspect the dynamotor after 500 hours of service or once a year, whichever period is shorter.

(a) Examine the brushes to see if they have worn properly and are free of hard spots. If such spots are apparent, renew the brush. Spotted brushes can be located by inspecting the commutator for grooves.

(b) Remove bearings from armature, clean with penetrating oil and carbon tetrachloride. Check bearings for tolerance and broken or chipped balls. Clean away all old grease and relubricate.

(c) Wipe off dirt from commutator, end bells, armature, and housing. If commutator does not have a smooth, even surface, place the armature in a lathe and rotate it. Polish the faulty commutator with a piece of soapstone or take a very thin (.003 inch) cut on a lathe. Do not use sandpaper as this causes deformation of the commutator bars. **Do not use emery cloth.** Remove all dust and dirt particles after polishing. A commutator should have a smooth, polished surface free of dirt, grease or ridges. **Do not turn down a commutator simply because it is discolored.** Under normal conditions, the commutators should not require turning down before the expiration of 5000 hours of service. After turning down, carefully examine the commutators to see if undercutting of mica is necessary. Use a small brush, such as a toothbrush, to remove any foreign particles that remain between the commutator bars.

(d) Remove all dirt and old grease from tuning mechanism. Lubricate gear and tuning shaft coupling as specified in paragraph 4, this section.

(2) TUNING CAPACITORS.—Inspect for dirt between plates. **Carefully** clean with a pipe cleaner. **Do not bend plates. Do not lubricate.** Do not blow out, as air hose may contain water and have sufficient pressure to bend the plates.

d. TYPE MN-28 REMOTE CONTROL.—Inspect as indicated in section V, paragraph 1b, above. Clean and lubricate dial tuning mechanism and tuning shaft coupling as in paragraph 4, this section.

e. TYPE MN-20A ROTATABLE LOOP.—Clean off all grease and dirt. Relubricate if necessary as specified in paragraph 4, this section.

f. TYPE IN-4A LEFT-RIGHT INDICATOR.—Inspect visually. Do not open inner case, as a faulty capacitor can be replaced by removing the outer case only. Replace faulty indicators, if necessary. Their repair must be made only by competent personnel at authorized instrument repair depots.

g. TEST PERFORMANCE.—Reassemble the compass and measure performance as described in paragraph 8, this section. Vibrate equipment and note any increase in noise or clicks with and without r-f input. If the compass unit is noisy or fails to meet performance requirements, re-examine it to discover the trouble.

h. WIRING.—Inspect bonding in aircraft. Inspect dynamotor safety wiring. Reassemble equipment and safety wire. Inspect antenna lead-in. Make replacements wherever necessary. Inspect the loop mounting for proper bracing.

i. FINAL CHECK.—Repeat the pre-flight inspection of this paragraph.

2. RADIO COMPASS UNIT ALIGNMENT. (See fig. 40.)

This equipment has been carefully adjusted and aligned by the manufacturer and thoroughly inspected before shipment. Circuits have been designed so that the alignment will be maintained over long periods of time. Before changing any adjustments, determine if the difficulty is not the result of normal deteriorating influences such as worn out vacuum tubes, blown fuses, improper operating voltages, broken cords, external r-f interference, etc. FACTORY ADJUSTMENTS ARE SEALED WITH PURPLE GLYPTAL AND SHOULD NOT BE ALTERED UNLESS ABSOLUTELY NECESSARY. Measure any questionable performance characteristics according to pargaraph 8, this section, before

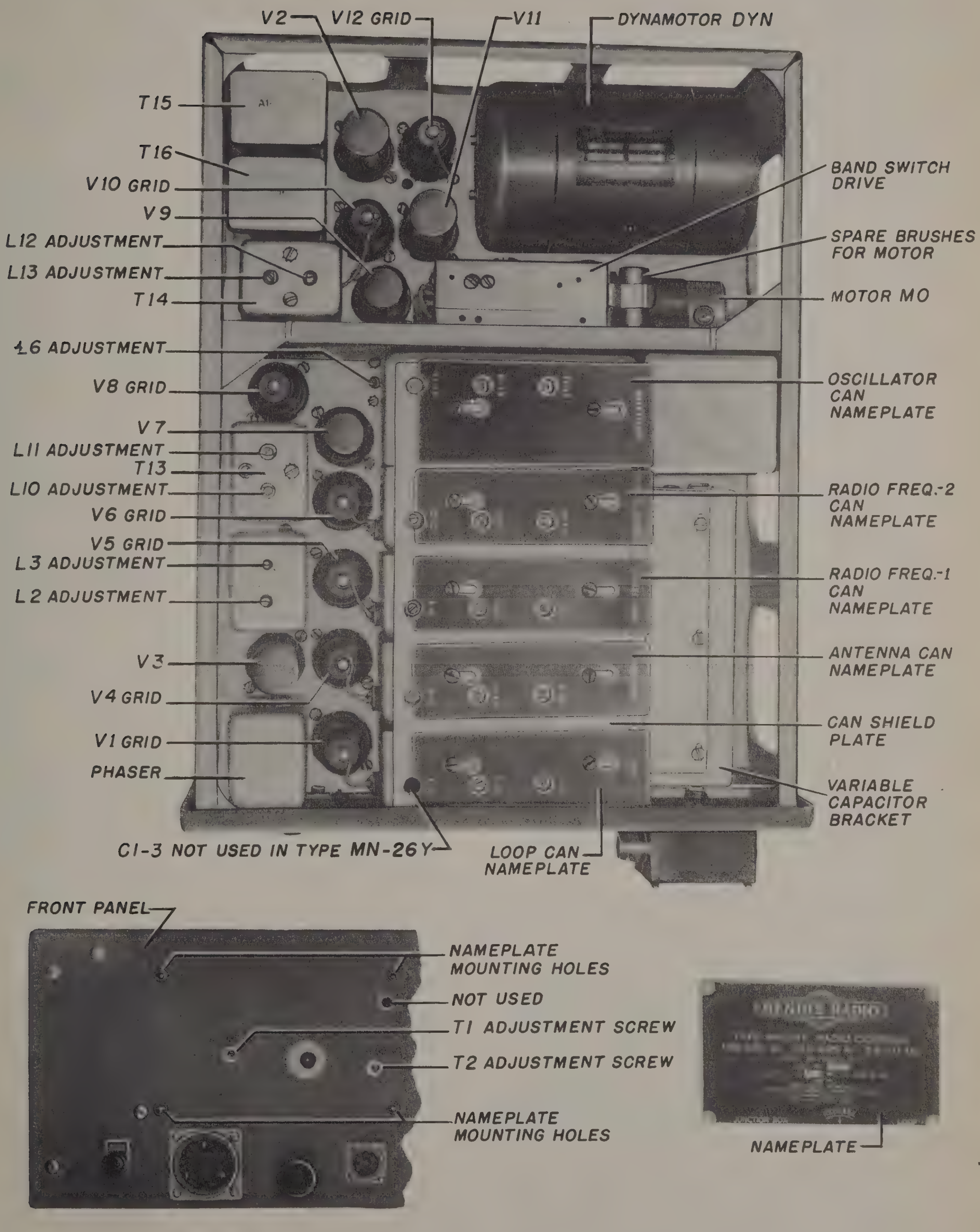


Figure 40—Type MN-26 Radio Compass, Alignment Controls*

and after adjustments. All aligning adjustments are accessible from the top of chassis (see fig. 40) and are given below.

Band	Alignment Frequency				Can Adjustments (All Models)				
	MN-26A MN-26C MN-26CA	MN-26M	MN-26W MN-26X	MN-26Y	Loop	Antenna	Radio Freq. 1	Radio Freq. 2	R-F Osc.
I	325	410	410	325	C1-1	C1-4	C1-7	C1-10	C1-13
II	695	850	850	695	C1-2	C1-5	C1-8	C1-11	C1-14
III	1500	7000	1750	7000	C1-3*	C1-6	C1-9	C1-12	C1-15

* Not used in Types MN-26M and MN-26W.

a. INTERMEDIATE FREQUENCY AMPLIFIER ALIGNMENT. (See fig. 40.)

(1) SECOND I-F STAGE ALIGNMENT.

(a) Turn function switch to "REC. ANT." and plug a 600-ohm output meter, (or 4000-ohm) as needed, in jack J1. Have other jack open. Set "AUDIO" on maximum. Set tuning dial to 695 kcs (or 850 kcs) on Band II.

(b) Apply a 112.5 kc signal, 30 per cent. modulated at 400 cycles, directly to the grid of i-f tube V8, leaving the regular grid clip in place. Adjust the signal generator output to about 100,000 microvolts.

(c) Adjust L12 and L13 of T14 for maximum output and reduce the signal generator voltage as necessary to keep the output of the radio compass unit at approximately 50 milliwatts. The input to tube V8 when T14 is properly aligned must be between 25,000 and 40,000 microvolts.

(d) While the signal generator is at exactly 112.5 kc turn off modulation and turn CW switch "ON." Adjust coil L6 for zero beat. The c-w oscillator will then oscillate at the i-f frequency and the zero beat method of aligning the r-f oscillator stage may be employed. After completion of alignment, readjust the c-w oscillator to 113.5 kc for the 1000-cycle-per-second difference frequency.

(2) FIRST I-F STAGE ALIGNMENT.

(a) With the dial still turned to 695 kc (or 850 kc) on Band II, the "AUDIO" control turned fully clockwise, and the "OFF-COMP.-REC. ANT.-REC. LOOP" switch on "REC. ANT." position, attach the lead from the signal generator to the grid of the first detector tube V6 through a 0.5 mfd capacitor. Remove the regular grid clip and shunt the grid of the first detector tube V6 with a 500,000-ohm resistor. Adjust the signal generator to 114.5 kc, 30 per cent. modulated at 400 cycles and an output of 1000 microvolts. Adjust L10 and L11 for maximum output. Reset the signal generator to a frequency of 110.5 kc and readjust L10 and L11 for maximum output.

(b) Next, tune the signal generator from 110 to 115 kc and observe the relative amplitude of the two peaks as indicated by the output meter. These peaks should be equal within 1 db and the dip should be at 112.5 kc, though they need not be symmetrical due to variations which may occur in the actual value of coupling in the first i-f.

(c) In the event the higher frequency peak is of greater amplitude, set the signal generator at a slightly higher frequency than 114.5 kcs and readjust inductors L10 and L11 for maximum output. If the higher frequency peak is of lesser amplitude, readjust L10 and L11 at a frequency slightly lower than 114.5 kcs. By one or more readjustments in this manner the peaks may be matched to the desired degree.

(d) Remember that two i-f peaks will not generally occur at exactly 110.5 kcs and 114.5 kcs because of the variations in coupling in the first i-f stage (mentioned above). The i-f transformers (T13 and T14) employ inductive coupling, with the first i-f slightly overcoupled to result in two peaks symmetrical with respect to the i-f of 112.5 kcs.

(e) Ground the grid of the heterodyne oscillator tube V7. Set the signal generator at 112.5 kcs and check the input to tube V6 required for a 50-milliwatt output. This input should be approximately 900 microvolts. See paragraph 8, this section, for c-w oscillator alignment.

b. R-F OSCILLATOR ALIGNMENT. (See fig. 40.)

(1) Turn function switch to "REC. ANT." position; set "AUDIO" control at maximum clockwise position, plug headset into J1, and couple the signal generator to the control grid of the first detector tube V6.

(2) Turn on c-w oscillator, which has previously been adjusted to 112.5 kc.

(3) Set the radio compass and the signal generator to 1500 kc for the MN-26A, MN-26C or MN-26CA types, to 1750 kcs for the MN-26W or MN-26X types, and to 7.0 mcs for the MN-26Y type of compass. The signal generator output should be 1000 microvolts, unmodulated. Rotate

trimmer C1-15 in the oscillator can of the radio compass for zero beat in the headphones.

(4) Set the radio compass and the signal generator to 695 kc for the MN-26A, MN-26C or MN-26Y types, or to 850 kc for the MN-26M, MN-26W or MN-26X types. Rotate trimmer C1-14 for zero beat in the headphones.

(5) Set the radio compass and the signal generator to 325 kc for the MN-26A, MN-26 or MN-26Y types, or to 410 kc for the MN-26M, MN-26W or MN-26X types of compass. Rotate trimmer C1-13 for zero beat in the headphones.

c. FIRST AND SECOND R-F AMPLIFIER AND ANTENNA STAGE ALIGNMENT. (See fig. 40.)—Turn the function switch to "REC. ANT." position and set the "AUDIO" control at maximum clockwise position. Set the signal generator for 30 per cent modulation at 400 cycles.

Plug an output meter into J1 and connect a signal generator to the antenna plug through a 100 micromicrofarad capacitor if the radio compass is a type MN-26A, MN-26C, MN-26CA, or MN-26Y, and a 50 micromicrofarad capacitor if the radio compass is a type MN-26M or MN-26X. If the compass is the type MN-26W use the same capacitor as the one mounted in antenna relay RE-1 which can be determined only by removing the relay cover and visually examining it since the capacitor varies with different serial numbers. Color codes will be either of the following:

Brown-black-brown—100 micromicrofarad

Green-black-black—50 micromicrofarad

(1) BAND III ALIGNMENT.—Set the radio compass and the signal generator at 7.0 mc. Adjust the signal generator output to produce less than 50 milliwatts output as measured by the output meter. Adjust the trimmers listed in the following table for maximum output, reducing the input from the signal generator as much as is necessary to keep the output at approximately 50 milliwatts. Set signal generator output at 10 microvolts. Reduce "AUDIO" control setting to a point at which slightly less than 50 milliwatts output is obtained. Touch up the following trimmers for maximum output.

Type Number	*Alignment Frequency*		
	Band I	*Band II*	*Band III*
MN-26A	150 kilocycles	325 kilocycles	695 kilocycles
MN-26C	150 kilocycles	325 kilocycles	695 kilocycles
MN-26CA	150 kilocycles	325 kilocycles	695 kilocycles
MN-26M	200 kilocycles	410 kilocycles	3400 kilocycles
MN-26W	200 kilocycles	410 kilocycles	850 kilocycles
MN-26X	200 kilocycles	410 kilocycles	850 kilocycles
MN-26Y	150 kilocycles	325 kilocycles	3400 kilocycles

NOTE

If subsequent sensitivity measurements indicate poor tracking at low frequency ends of the bands, adjustment of the oscillator coil inductance on one or more bands will be necessary. The same equipment setup and procedure used at the high frequency ends of the bands is used for this adjustment. To make the alignment adjust the setting of the iron core screws (glyptalled factory adjustment) in T10, T11, or T12 (Bands I, II, and III oscillator transformers, respectively) as the case may be. After making these adjustments, apply glyptal to the screws again. If any alteration of the oscillator coil inductance is made, repeat the oscillator alignment procedure at the high frequency ends of the band or bands in question as outlined above. The low frequency end of the three bands is given in the table below.

Compass Type	Alignment Frequency	*Band III Trimmers*		
		Antenna	*Radio Freq. 1*	*Radio Freq. 2*
MN-26A MN-26C MN-26CA	1500 kc	C1-6	C1-9	C1-12
MN-26W MN-26X	1750 kc	C1-6	C1-9	C1-12
MN-26M MN-26Y	7000 kc	C1-6	C1-9	C1-12

(2) BAND II ALIGNMENT.—Repeat the procedure described in paragraphs 2c and 2c(1) above, using the frequency and trimmers listed in the following table in place of those used for Band III alignment.

Compass Type	Alignment Frequency	*Band II Trimmers*		
		Antenna	*Radio Freq. 1*	*Radio Freq. 2*
MN-26A MN-26C MN-26CA MN-26Y	695 kc	C1-11	C1-8	C1-5
MN-26 MN-26W	850 kc	C1-11	C1-8	C1-5

(3) BAND I ALIGNMENT.—Repeat the procedure described in paragraphs 2c and 2c(1) above, using the frequency and trimmers listed in the following table in place of those used for Band III alignment.

Compass Type	Alignment Frequency	*Band I Trimmers*		
		Antenna	*Radio Freq. 1*	*Radio Freq. 2*
MN-26A MN-26C MN-26CA MN-26Y	325 kc	C1-10	C1-7	C1-4
MN-26M MN-26W	410 kc	C1-10	C1-7	C1-4

d. ADJUSTMENT OF I-F REJECTION TRAPS. (See fig. 40.)

(1) Connect a signal generator to the compass unit antenna plug through a capacitor. (Refer to par. 2c, above.) Tune the compass and the signal generator to 150 kc for Types MN-26A, MN-26C or MN-26Y, or 200 kc for Types MN-26M, MN-26W or MN-26X. Signal generator output should be 4 microvolts, 30% modulated at 400 cycles. Adjust "AUDIO" control to a point at which 500 milliwatt output is obtained.

(2) Reset the signal generator to 114.5 kc and adjust the signal generator output to 1 volt. Leaving the signal generator set at this frequency, adjust the iron core of L3 until minimum output is obtained.

(3) Reset the signal generator to 110.5 kc with 1 volt output and adjust the iron core of L2 for minimum output.

(4) With these adjustments made as described, there should be not more than 30 milliwatts of power output with 1 volt of input.

e. LOOP ALIGNMENT. (See fig. 40.)

(1) Set the equipment as for a standard radio compass test setup. Turn the loop parallel to the transmission line and set the function switch to "REC. LOOP" position.

(2) Tune compass and set signal generator to 325 kc for Band I or 695 kc for Band II. Adjust the signal generator for an input to the loop of approximately 100 microvolts per meter, 30% modulated at 400 cycles. Adjust the LOOP can trimmers listed in the following table for a maximum indication on the output meter, adjusting the "AUDIO" control to maintain output meter readings below 50 milliwatts.

Compass Type	Band I		Band II		Band III	
	Alignment Frequency	Trimmer	Alignment Frequency	Trimmer	Alignment Frequency	Trimmer
MN-26A	325 kc	C1-1	695 kc	C1-2	1500 kc	C1-3
MN-26C	325 kc	C1-1	695 kc	C1-2	1500 kc	C1-3
MN-26CA	325 kc	C1-1	695 kc	C1-2	1500 kc	C1-3
MN-26M	410 kc	C1-1	850 kc	C1-2	NOT	USED
MN-26W	410 kc	C1-1	850 kc	C1-2	1750 kc	C1-3
MN-26Y	325 kc	C1-1	695 kc	C1-2	NOT	USED

(3) If loop sensitivity is unsatisfactory at the low frequency end of band or bands, adjust the inductance of the loop coils, T1, T2, and T3. This may be accomplished by repeating the procedure outlined above, adjusting the iron cores, which have been glyptalled in place at the factory, for maximum indication on an output meter. Make these adjustments at the low frequency ends of the band as listed in the following table. If it is necessary to change the settings of any of these iron core adjustments, be sure to readjust the trimmers C1-1, C1-2, and C1-3 as outlined above.

Compass Type	Band I		Band II		Band III	
	Alignment Frequency	Coil	Alignment Frequency	Coil	Alignment Frequency	Coil
MN-26A	150 kc	T1	325 kc	T2	695 kc	T3
MN-26C	150 kc	T1	325 kc	T2	695 kc	T3
MN-26CA	150 kc	T1	325 kc	T2	695 kc	T3
MN-26M	200 kc	T1	410 kc	T2	NOT	USED
MN-26W	200 kc	T1	410 kc	T2	850 kc	T3
MN-26Y	150 kc	T1	325 kc	T2	NOT	USED

NOTE

The adjustment screws for the LOOP can inductances T1, T2, and T3 are accessible by removal of the name plate on the front panel. (See figure 40.)

f. C-W OSCILLATOR ADJUSTMENT. (See fig. 40.)

(1) Turn function switch to "REC. ANT." and plug a headset into the "TEL." jack, J1. Set tuning dial to 695 kc (or 850 kc). Attach the lead from the signal generator through a 0.5 mfd capacitor, to the grid of the first detector tube V6, removing the regular grid clip at the top of the tube. Shunt this grid with a 500,000-ohm resistor.

(2) Apply a 113.5 kc signal unmodulated. The signal generator output should be approximately 1500 microvolts.

(3) Adjust c-w oscillator coil L6 for zero beat in the headphones.

3. TROUBLE LOCATION AND REMEDY.—When one trouble has been found and remedied, check the equipment for proper operation. If unsatisfactory results are obtained, follow from the beginning the procedure outlined below to locate further sources of trouble. Before removing the equipment from the aircraft, ascertain that the fuse in the remote control is not burned out, that battery voltage is normal, that all cables are connected, and make sure that the non-directional vertical antenna and lead-in are not grounded or open.

a. LOW COMPASS OUTPUT—ALL BANDS.—

(1) TEST RECEIVER OUTPUT.—Turn the function switch to the "REC. ANT." position. Tune to stations in each band and note whether trouble is experienced on only one or two bands. If so, proceed as outlined in paragraph 3b, following. If the equipment operates satisfactorily as a receiver

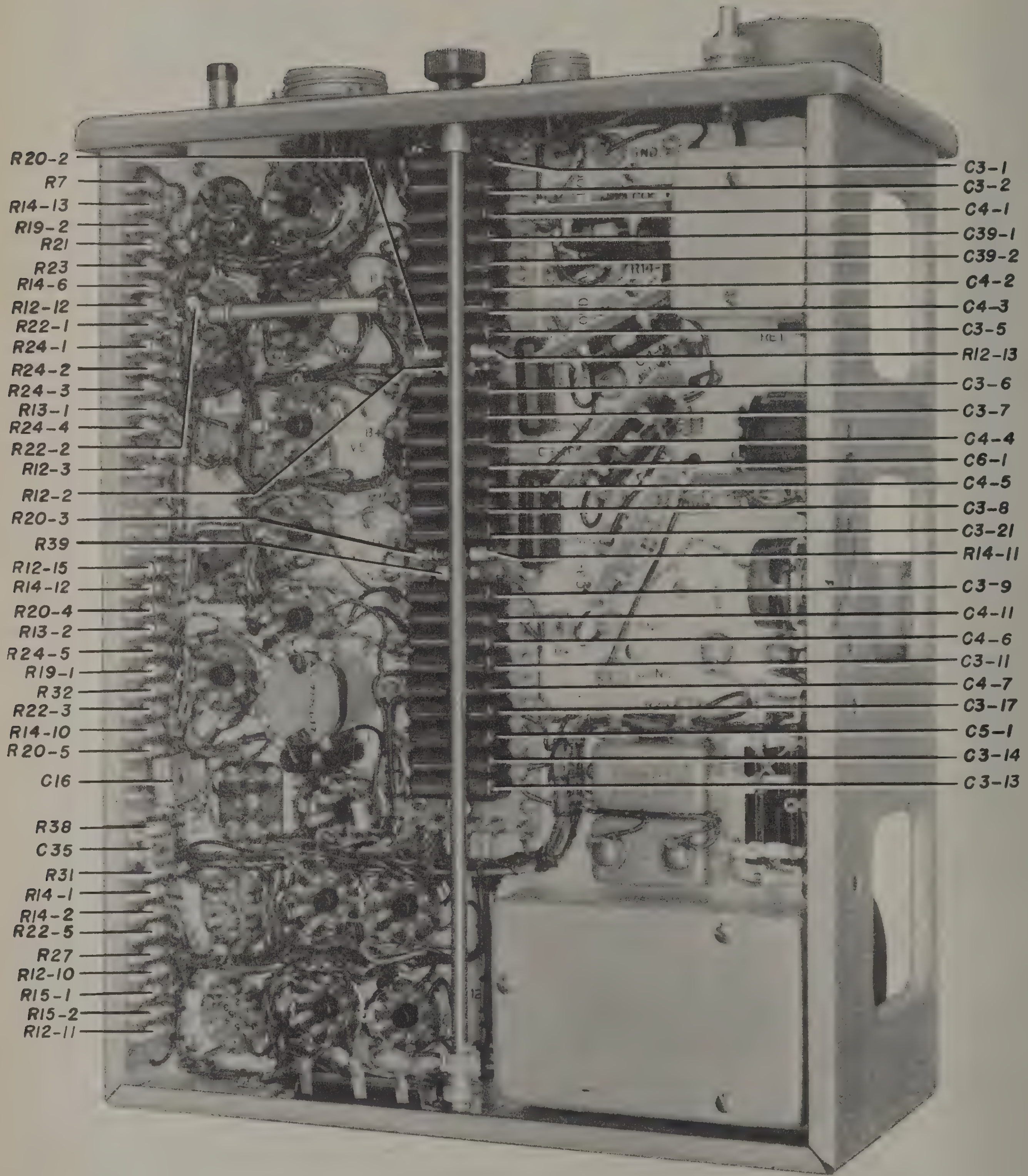


Figure 41—Type MN-26 Radio Compass, Right Bottom View of Chassis*

on all bands, check "REC. LOOP" operation of the equipment. If the equipment operates satisfactorily under both conditions, the trouble must be associated with the compass circuits. Proceed as outlined in the following paragraphs. If, however, the "REC. LOOP" operation of the equipment is unsatisfactory, proceed as outlined in paragraph 3d, this section. If trouble is encountered on all bands, proceed as outlined in paragraph 3c, this section.

(2) NORMAL RECEIVER OUTPUT (ANTENNA OR LOOP).—When normal "REC. ANT." and "REC. LOOP" operation is obtained on all bands the trouble must lie in the compass circuits, and tests outlined in the following paragraphs should be made in sequence.

(3) AUDIO OSCILLATOR TEST.—With a vacuum tube voltmeter, measure a-c voltage between ground and terminals 3 and 5 of the indicator. Connect a 0.1 mfd, 400-volt capacitor in series with the voltmeter. If the a-f oscillator stage and the indicator are functioning properly, there will be an a-c voltage of from 18 to 22 volts between ground and terminals 3 and 5.

(4) COMPASS OUTPUT AMPLIFIER TEST.—Test tube V12 for emission and characteristics. Set the function switch to the "COMP." position. Measure the socket voltages on the above tube and compare the readings obtained with the values given in the table in paragraph 6, this section. If considerable variation is noted from the typical values, check wiring and components of the circuits associated with the tube elements. Disconnect the compass indicator. Turn "COMPASS" control full on and apply a 1.5-volt, 48-cycle signal from an audio oscillator between ground and the junction capacitor of C7 and resistor R32. Connect an output meter between terminals 3 and 4 of compass output transformer can T16. If this stage is functioning properly, it will be possible to obtain an output of at least 5 milliwatts. If the transformer is defective, the entire transformer can assembly must be replaced. Check capacitor C7 for open or short circuit.

(5) LEFT-RIGHT INDICATOR TEST.—Check indicator and its associated cables for opens, shorts, and poor contacts. If the tests outlined above show no voltage across the indicator field with indicator connected, check the meter and its resonating condenser for shorts. When one indicator is being used, check the meter field load assembly for shorted or open conditions. If two left-right indicators are used, check one at a time by disconnecting the other and inserting the meter field load assembly supplied with the indicator in its place. If the moving coil of the indicator is intact, check between indicator terminal 4 and compass output transformer terminal 4 for open circuit. Proceed with tests outlined in paragraph 8, this section.

b. LOW "REC. ANT." OUTPUT—ONE OR TWO BANDS.—If operation of the receiver is obtained on one or two bands, the necessity of checking operation of i-f, 2nd detector, audio, etc., circuits is unnecessary as it is obvious that these stages must be functioning to permit operation of at least one band. Proceed to the tests outlined in paragraph 3c below.

c. LOW "REC. ANT." OUTPUT—ALL BANDS.

(1) MISCELLANEOUS.—When both signal and noise output are low or absent, first check all external cable connections, including antenna connections, power supply connections, fuses, and headphone connections. Also, remove the cover of the antenna switching relay RE1 assembly and check operation of the relay, resistor R18-1, capacitor C21-1, and the relay contacts (see fig. 44).

(2) REMOTE CONTROL UNIT.—Remove Type MN-28 Remote Control from its base and check wiring, components, and switch contacts for opens, shorts, and grounds. Continuity tests should be made back through the cable and junction box to the plug at the radio compass.

(3) POWER SUPPLY.—Failure of the primary power source may normally be detected by failure of the instrument lamps. The supply voltage (approximately 28 volts) should appear across the yellow and black leads under the hash filter cover (see fig. 44). If no supply voltage appears at this point, check the continuity of the wiring and the contacts of switch S8 (see figs. 45 and 46). If supply voltage is normal, approximately 200 volts should appear across the red and black leads under the hash filter cover (see fig. 44). If this voltage is unreasonably low, check for short circuits in wiring or components associated with or connected to the high voltage supply. Lack of dynamotor output voltage, if the primary supply is normal, indicates a defective dynamotor.

(4) TUBES.—Test all tubes for emission and other characteristics. Replace any tubes not having characteristics within standard limits.

(5) VOLTAGE MEASUREMENTS.—Measure socket voltages with the function switch in the "REC. ANT." position and compare them with the values given in the table in paragraph 6, this section. If any considerable variation from typical values is noted, check all resistors, capacitors, and wiring in circuits associated with the tube elements.

(6) AUDIO OUTPUT AMPLIFIER TEST.

(a) Plug a headset into the "TEL." jack on Type MN-28 Remote Control and while listening, touch the grid cap of the second detector tube V10 (see fig. 43). A loud click or whistle should be heard. If no sound is heard, measure the socket

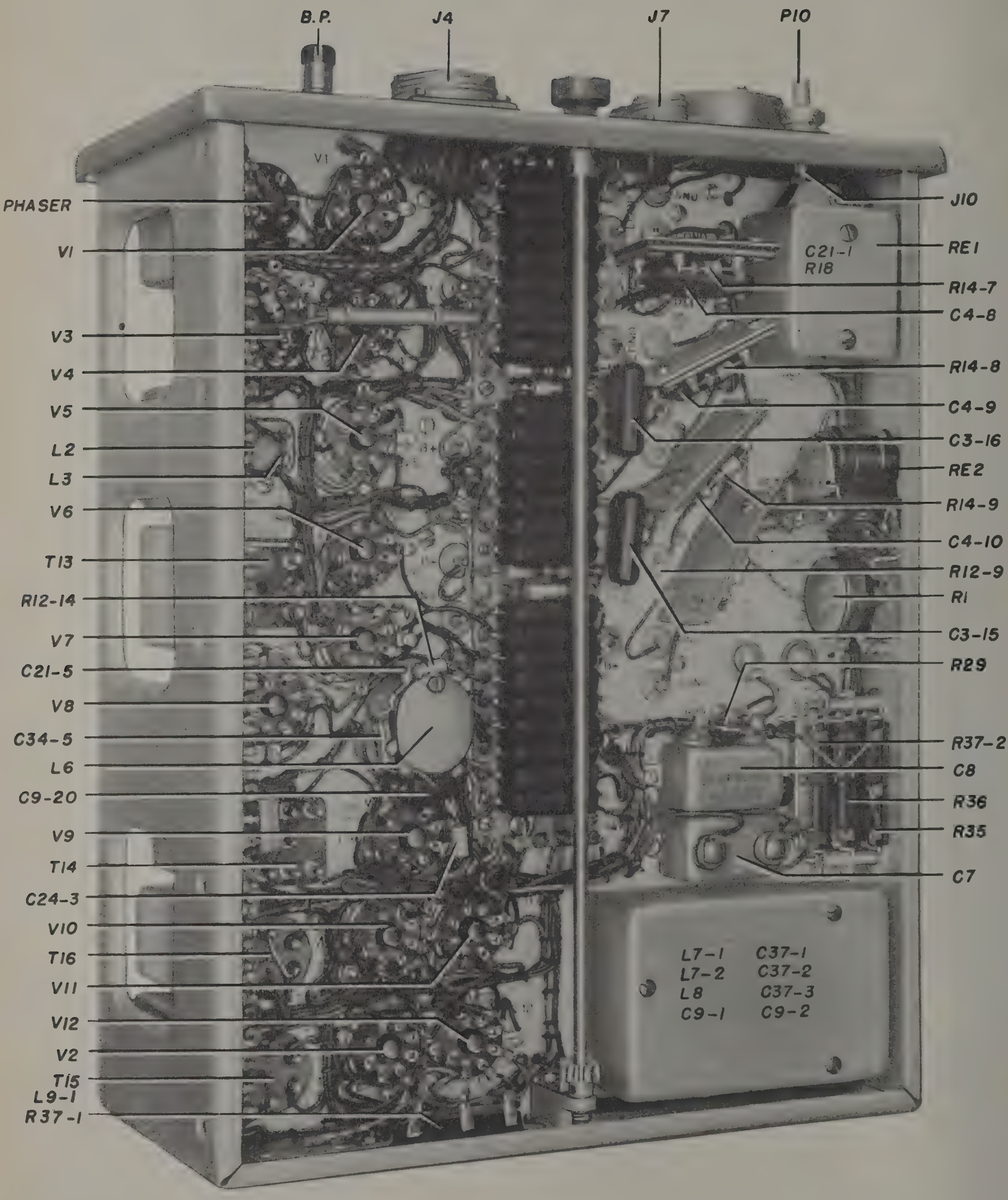


Figure 42—Type MN-26 Radio Compass, Left Bottom View of Chassis*

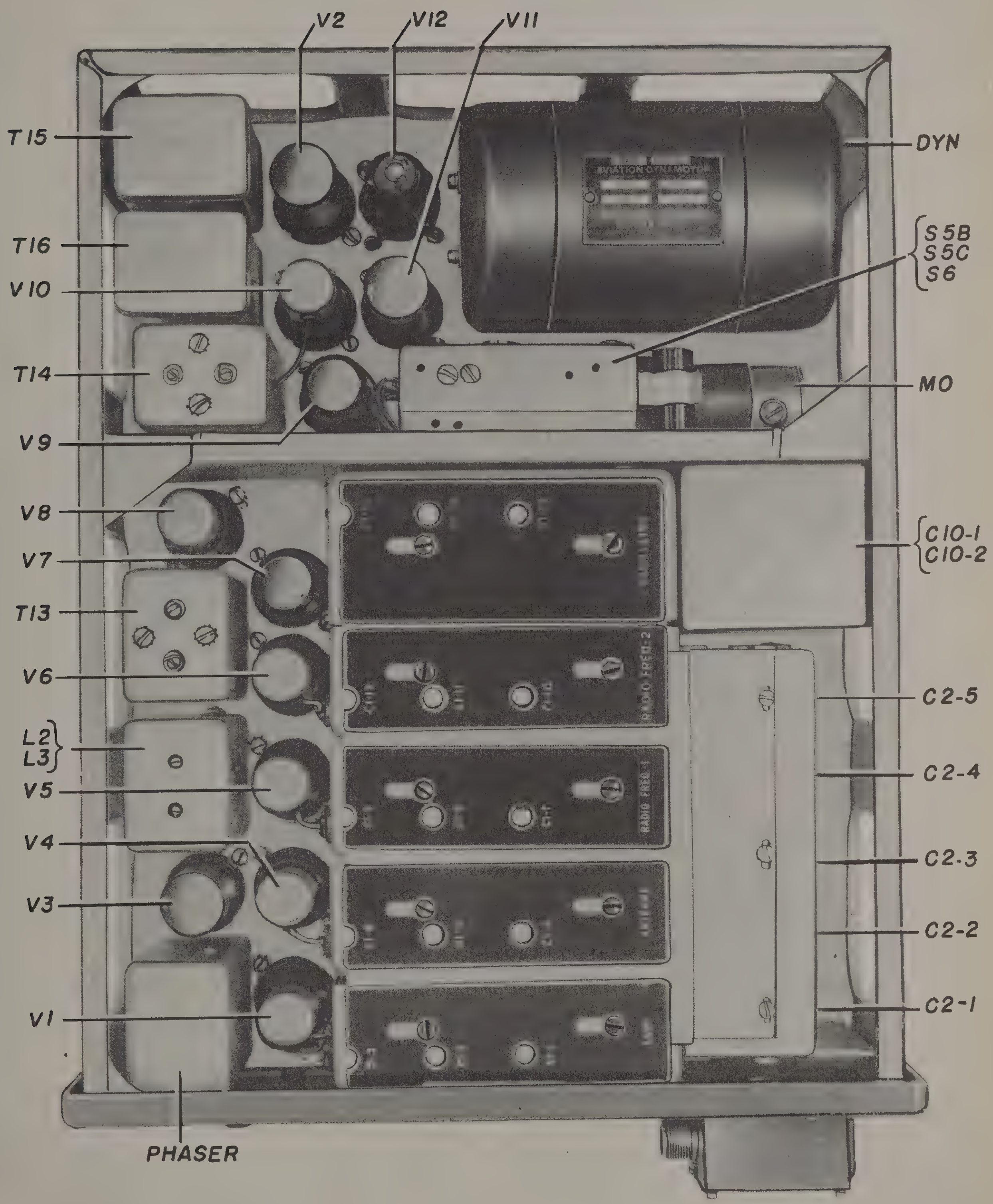


Figure 43—Type MN-26 Radio Compass, Top of Chassis*

voltages of the audio output tube V11, and the second detector tube V10, and compare readings obtained with the values given in the table in paragraph 6, this section. If any considerable variation from the typical values is noted, check wiring and components in the circuits associated with the tube elements.

(b) Apply a 400-cycle signal from an audio oscillator to the grid of the audio output tube V11 (socket terminal 5, see fig. 47); plug an output meter into "TEL." jack J1 and measure the audio oscillator voltage required for an output of 50 milliwatts. If the stage is functioning properly, it will be possible to obtain this output with an audio oscillator voltage of less than 1.5 volts. Likewise, an audio oscillator voltage of approximately .025 volts applied to the grid of the second detector tube V10 (see fig. 43), should give an output of 50 milliwatts. If the output is low when feeding the audio oscillator into the grid of the second detector V10, but normal when feeding into the grid of the audio output tube V11, connect the audio oscillator through a 1.0 mfd capacitor to the plate of the second detector tube V10 (socket terminal 3). If satisfactory output is obtained when the audio oscillator is connected to the grid of the audio output tube V11, but not when connected to the plate of the second detector tube V10, capacitor C16 or the relay RE2 contacts are defective.

(7) AVC CIRCUIT TESTS.—Extreme insensitivity of the radio compass unit may be caused by failure of C4-8, C4-9, or C4-10, which would remove the r-f ground from the grid return of the associated stage. If the avc is inoperative, check C6-1 for short circuit. A defective tube in the second detector stage may also cause ineffective avc operation.

(8) I-F AMPLIFIER TESTS.—Apply a 112.5 kc signal, 30 per cent. modulated at 400 cycles, to the grid of the i-f tube V8 and plug an output meter into the "TEL." jack. Measure the signal generator voltage required to produce an output of 50 milliwatts. If this stage is functioning properly, a signal generator input of less than 50,000 microvolts will be required. If more than 50,000 microvolts is necessary, adjust L12 and L13 to determine whether or not the sensitivity is due to misalignment of T14. If satisfactory alignment cannot be obtained, remove T14 and check all wiring and components. If function of this stage is normal, ground the grid of the r-f oscillator tube V7, and apply a 112.5 kc signal, 30 per cent. modulated at 400 cycles, from the signal generator to the grid of the first detector tube V6 through a 0.5 mfd capacitor. Remove the regular grid clip, and shunt the grid of the first detector tube V10 with a 500,000-ohm resistor. If this stage is functioning properly, an input of less than 900 microvolts will be necessary to produce an output of 50 milliwatts. If an input of more than 900 microvolts is necessary, carefully check alignment of T13. This alignment procedure may be found in paragraph 2a, this section. If satisfactory alignment and sensitivity of this stage cannot be obtained, remove T13 and check all wiring and components.

(9) R-F SYSTEM TESTS.—Set the band switch to one of the bands on which trouble is encountered. Set the tuning dial to the alignment frequency for that band, see paragraph 2e, this section. Beginning at the grid of the first detector tube V6, apply a 30 per cent modulated (400 cycles) signal from the signal generator.

Nine hundred microvolts input to this stage from the signal generator should give approximately 50 milliwatts output from the audio output amplifier. As the signal is fed successively into the grids of the second r-f, first r-f stages, etc., considerably less input from the signal generator should result in the same 50 milliwatts output. If a stage is reached where the signal necessary to produce 50 milliwatts output is greater than or only slightly less than it was for the preceding stage, that stage is faulty. Test the faulty stage as outlined in the next two paragraphs.

(10) R-F OSCILLATOR TESTS.—If socket voltage measurements on the first detector tube V6 fail to reveal the source of trouble, set the band switch to one of the inoperative bands and rotate the tuning dial to the alignment frequency for that band, as given in paragraph 2, this section. Apply a signal generator voltage of that frequency, 30 per cent. modulated at 400 cycles to the grid of the first detector tube V6 as described in paragraph 3c(8) above. Turn "AUDIO" control fully clockwise. It should be possible to obtain an output of 50 milliwatts at the "TEL." jack for an input of less than 900 microvolts from signal generator. If these conditions can be met, the trouble is in one of the r-f stages and the procedure outlined in the next paragraph should be followed. If the conditions cannot be met, check the alignment of the r-f oscillator, following the procedure given in paragraph 2b, this section. If satisfactory alignment is not obtainable, remove the r-f OSCILLATOR assembly (see fig. 40), and check all wiring, contacts of switch S4, capacitors, resistors, and inductors.

(11) R-F AMPLIFIER TESTS.—If socket voltage measurements on the first and second r-f tubes fail to reveal the source of trouble, set band switch to one of the inoperative bands and rotate tuning dial to alignment frequency for that band, as given in paragraph 2, this section. Apply a signal generator voltage of that frequency, 30 per cent. modulated at 400 cycles, to the grid cap of the second r-f tube V5. It should be possible to obtain an

output at the "TEL." jack of 50 milliwatts for an input of less than 120 microvolts from the signal generator. If these conditions cannot be met, check the alignment of the second r-f circuit, following procedure given in paragraph 2b, this section. If satisfactory alignment is not obtainable, remove the "RADIO FREQ.-2" assembly (see fig. 40), and check wiring, switch contacts, capacitors, and resistors. If satisfactory output is obtainable from the second r-f stage, repeat the procedure outlined above for the first r-f stage. It should be possible to obtain an output of 50 milliwatts with an input of 20 microvolts to the grid of the first r-f tube V4. If the first r-f stage is functioning properly, apply a 5-microvolt signal to the antenna pin on the panel of the compass unit, and if 50 milliwatts or more output, with no more than 12.5 milliwatts of noise is not obtainable, check antenna relay contacts, resistor R18-1, capacitor C21-1 (or capacitor C43-1) and operation of the relay RE1. If normal operation is still unobtainable, remove the ANTENNA can assembly, and check wiring, switch contacts, capacitors and antenna coils located in T4, T5, and T6.

d. LOW "REC. LOOP" OUTPUT.—Turn the function switch in "REC. LOOP" position. Tune to stations in each band, observing whether trouble is encountered on all bands or only on one or two bands. If equipment is inoperative on all bands, proceed as outlined in paragraph 3d(1), below. If, however, trouble is encountered on only one or two bands, remove the compass unit from the cabinet and set up on the test bench. Measure voltage on the plates of modulator tube V3 for each setting of the band switch. If any considerable variation is noted from values given in paragraph 8, this section, remove the ANTENNA can assembly, and check contacts of S1-2 and plate winding of T4, T5, and T6 for open or short circuits. If the nature of the trouble encountered on only one or two bands is not apparent from the foregoing tests, proceed as outlined in paragraph 3d(2) below.

(1) MODULATOR TEST.—Measure socket voltages of the modulator tube V3 and compare with values given in the voltage table. If any considerable variation from typical values is noted, check wiring and components of the circuits associated with the tube elements. With the function switch in "COMP." position and the compass unit tuned to the aligning frequency (paragraph 2, this section), on any one of the faulty bands, set the loop gain R1, "COMPASS," R3, and threshold sensitivity R2, controls at maximum and ground grid 1 (socket terminal 4) of the modulator tube V3. Apply a 7-microvolt signal generator voltage of the aligning frequency to grid 2 (socket terminal 5) of the modulator tube V3 and observe the left-right compass indicator. If the modulator stage is functioning properly, the indicator pointer will deflect full scale to right. Repeat test, grounding grid 2 and applying signal to grid 1. The indicator pointer should deflect full scale to left.

(2) LOOP AMPLIFIER TEST.—Measure the socket voltages of tube V1 and compare readings obtained with values given in the voltage table. If any considerable variations from typical values are noted, check wiring and components of circuits associated with the tube elements. If all bands are inoperative, remove the phaser can assembly (see fig. 42) and check all wiring and components for open or short circuits. If only one or two bands are inoperative, roughly check alignment of loop stage trimmers of the bands at fault. If proper alignment appears impossible, remove the LOOP can assembly and check all components, switch contacts, and wiring.

(3) LOOP TEST.—Test loop, mounting (brushes and rings on rotatable mounting), and loop cable for open or short circuits or grounds. Also check for poor contact at plugs.

(4) LOOP STAGE ALIGNMENT.—If it has been necessary to make any alteration in the settings of the loop stage trimmers, it will be necessary to realign this stage completely. Follow the procedure outlined in paragraph 2e, this section.

e. NOISY COMPASS OR RECEIVER OPERATION.—To locate the cause of noisy operation, check the following components:

Check	*For*
Vacuum tubes	Microphonic or defective tubes
Dynamotor	Worn or arcing brushes
Loop	Dirty or flattened pins
Loop mounting	Corroded sockets, dirty brushes or rings
Cable plugs	Poor contacts
Bonding	Loose connections. Chassis not grounded.
Switches	Dirty contacts
Variable capacitors	Dirt between plates
Power source	Loose or corroded connections
Circuits	Loose wires, defective capacitors or resistors

4. LUBRICATION.

a. The following parts require lubrication after the hours of service indicated below:

Part	*Time*	*Lubrication*
Dynamotor	1000 hours	AN-G-3a
Loop mounting gears and bearings	1000 hours	AN-G-3a
Radio compass and remote control tuning gears and bearings	1000 hours	AN-G-3a
Mechanical tuning shafts	As required	Gargoyle Grease A No. 0

b. **Do not lubricate the variable tuning capacitor, potentiometers or dynamotor commutator.** Band switch motor "MO" is permanently lubricated and will not require attention, unless it is disassembled, in which case repack the bearings with Beacon M-285 low temperature grease. If the dial gear mechanism is disassembled, repack the ball bearings with Beacon M-285 low temperature grease.

5. DISASSEMBLY OF UNITS.

a. REMOVAL OF RADIO COMPASS FROM MOUNTING BASE.—Turn the three Dzus fasteners, lift the front of the cabinet and pull forward.

b. REMOVAL OF RADIO COMPASS CHASSIS FROM CABINET.—Turn the "RELEASE" knob on the front panel to the left until the chassis will slide out of the cabinet by pulling the panel forward. Pull the chassis from the cabinet. The chassis may be placed on any one of five sides (but not on front panel) without injury to its components.

c. REMOVAL OF HASH FILTER COVER.—Remove the three mounting screws which secure the hash filter cover (see a, b, and c, of fig. 44).

d. REMOVAL OF DYNAMOTOR.—Remove the three mounting screws (see a, b, and c, of fig. 44) and remove hash filter cover. Remove the red, yellow, and black wires from terminals R, Y, and B of hash filter terminal board TB4. Cut the dynamotor tie wire and remove the dynamotor mounting screws (see d and e of fig. 44). Do not allow the dynamotor to drop.

e. DYNAMOTOR DISASSEMBLY.

(1) Cut the safety wire on the screws which secure the dust covers, remove the screws, and slide off the dust covers.

(2) Unscrew the brush-holder caps, and remove the brushes.

(3) Disconnect the leads from the brush holders on each end of the dynamotor. Unscrew the frame bolts, and remove the end brackets. Slide out the armature.

(4) Unscrew the field-retaining screws and remove the fields. Be careful not to damage the wiring or insulation.

(5) In reassembling the dynamotor, make certain that the armature is replaced in proper position. The commutator with the wide segments should be at the low-voltage end-bracket. Clean out carefully any other foreign matter which might interfere with the armature clearance. Replace the brushes in their proper location with the "+" or "—" markings on the brush facing the corresponding markings on the end bracket. Apply glyptal cement to the frame bolts and field-retaining screws. Replace safety wires.

f. DISASSEMBLY OF BAND SWITCHING COMPONENTS.

(1) REMOVAL OF BAND SWITCH DRIVE SHAFT.—Remove the four screws which secure the nameplate to the front panel, and remove the nameplate. Remove the large black phenolic plug which covers the end of the shaft. Withdraw the band switch drive shaft by pulling it out with long nose pliers.

(2) REMOVAL OF OSCILLATOR, RADIO FREQ.-2, RADIO FREQ.-1, ANTENNA AND LOOP CANS.—Remove the band switch drive shaft (paragraph 5f(1) above). Remove the screws which secure the can nameplates to the cans and remove the can nameplate. Lift off the can shield-plate and remove the three screws which secure the variable-capacitor-bracket and remove bracket. Remove the grid cap from the tube which is associated with the can that is to be removed. See figure 43. Turn the compass to expose the side shown in figure 44. Unsolder the leads from the terminals of the cans and remove the screws which secure the cans to the chassis. The terminals and screws are as follows:

(*a*) OSC. CAN.—The screws which secure the OSCILLATOR can are f and p of figure 44. The terminals are as follows:

Chassis Stenciling	*Wire Color*	*Wire Connects to*
G	Green	V7 term. 5
P	Blue	V7 term. 3
INJ. G	Green	V6 term. 5
B+	Red	TB2 term. 51
GND.	Black-Green	C2-5 rotor (gnd.)
COND.	Green	C2-5 stator

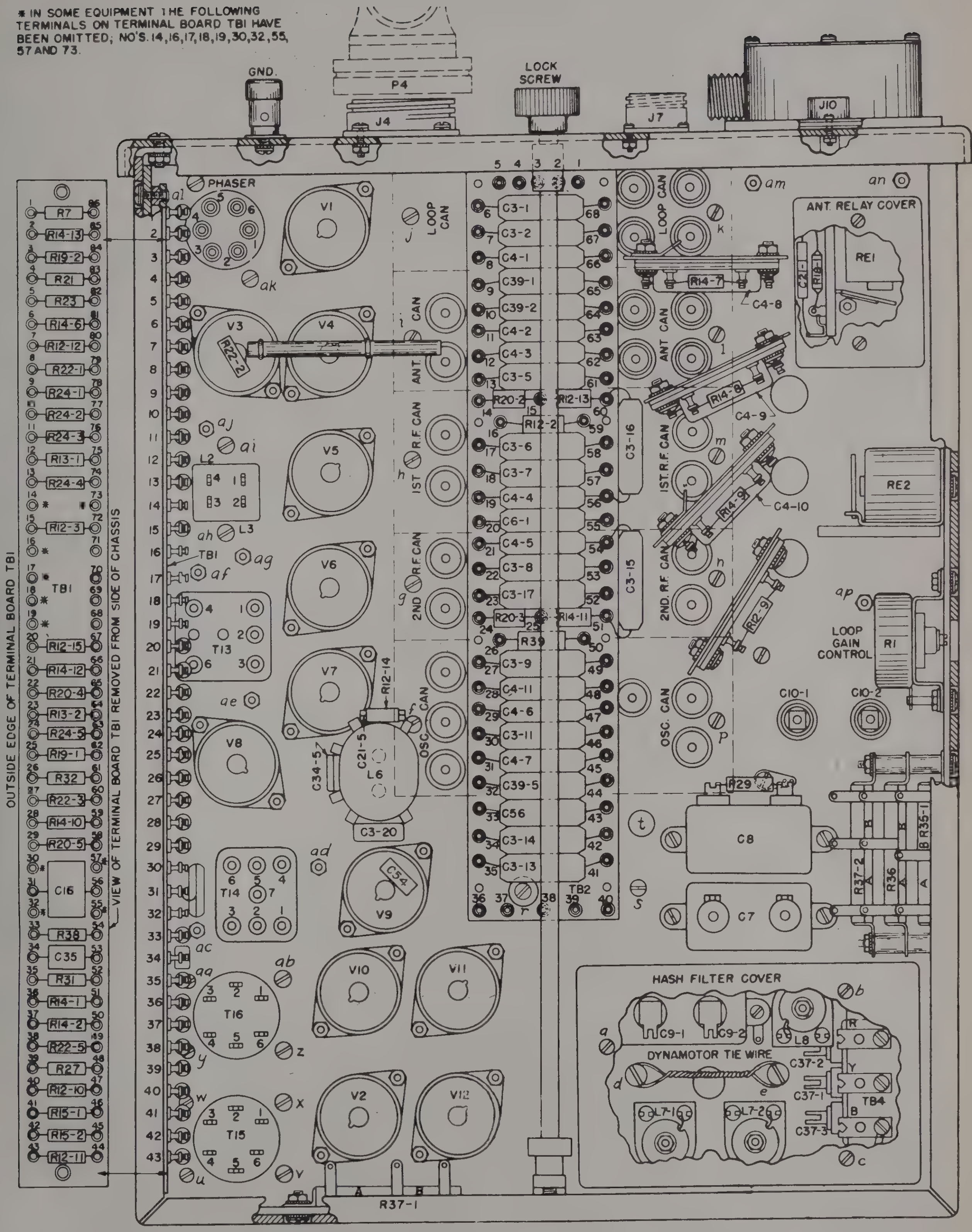


Figure 44—Type MN-26 Radio Compass, Chassis Layout*

(b). 2ND R-F CAN.—The screws which secure the RADIO FREQ.-2 can are g, and n of fig. 44. The terminals are as follows:

Chassis Stenciling	*Wire Color*	*Wire Connects to*
B+	Red-Green	TB2 term. 24
P	Blue	V5 term. 3
A.V.C.	Black-Green	Junct. C4-10 & R14-9
COND.	Green	C2-4 stator

(c). 1ST R-F CAN.—The screws which secure the RADIO FREQ.-1 can are h, and m of fig. 44. The terminals are as follows:

Chassis Stenciling	*Wire Color*	*Wire Connects to*
B+	Red-Green	TB2 term. 17
P	Blue	V4 term. 3
A.V.C.	Black-Green	Junct. C4-9 & R14-8
COND.	Green	C2-3 stator

(d). ANT. CAN.—The screws which secure the ANTENNA can are i and l of fig. 44. The terminals are as follows:

Chassis Stenciling	*Wire Color*	*Wire Connects to*
P (nearest panel)	White-Orange	V3 term. 3
P	White-Black	V3 term. 6
ANT.	White-Green (Black spaghetti covered)	RE1
A.V.C.	Black-Green	Junct. C4-8 & R14-7
COND. (nearest terminal board)	Red-White	TB2 term. 60
COND.	Green	C2-2 stator

(e). LOOP CAN.—The screws which secure the LOOP can are j and k of fig. 44. The terminals are as follows:

Chassis Stenciling	*Wire Color*	*Wire Connects to*
LOOP (nearest front panel)	Green	J7 term. 5
LOOP	Green-White	J7 term. 1
GND.	Black	J7 term. 3
COND.	Green	C2-1 stator

(3) REMOVAL OF BAND SWITCH DRIVE ASSEMBLY.

(a). Unsolder the following wires from terminal board TB2 and ground lug of the tube socket for V9 (wires protrude from hole t of fig. 44).

Wire Color	*Connection*
Slate	TB2 term. 40
Orange	TB2 term. 39
Blue-White	TB2 term. 38
Brown	TB2 term. 37
Yellow	TB2 term. 36
Black	V9 ground lug

Remove the band switch drive shaft [paragraph 5f(1) above]. Remove the two band switch drive mounting screws (r and s of fig. 49) and lift out band switch drive assembly.

(b). When reassembling, make sure that the arm of each wafer switch is in the same relative position before attempting to reinsert the band switch drive shaft. This may be ascertained by sighting through the shaft hole and noting the location of the positioning cut-out in each switch arm. Do not force the band switch drive shaft since this may damage the switch wafers. After the band switch drive shaft is engaged with **all** of the switch wafers, rotate it **with the fingers** to make certain that it is operating freely.

(4) DISASSEMBLY OF BAND SWITCH DRIVE ASSEMBLY.—After removing [see paragraph 5f(3) above], the band switch drive, disassemble it by removing the three screws which hold the two halves of the housing together. When reassembling, apply glyptal cement to the screws.

(5) DISASSEMBLY OF BAND SWITCH MOTOR.—The band switch motor is secured to the band switch drive assembly by four screws.

(a) Unsolder the red, blue, and brown motor wires from the wafer switch S5.

(b) Loosen the set screws and remove the worm from the motor shaft.

(c) Loosen the brush-retaining screws in the side of the motor and withdraw the brushes.

(d) Remove the two screws from the brush bell (nameplate end of motor). Tap the rim of the front end-bell **lightly** with a wooden mallet or block until it separates enough from the housing to permit inserting a screwdriver blade. Pry the end-bell off the housing, being careful not to damage either.

(e) The armature will probably be removed with the end-bell, and if so, can be separated from it by tapping lightly on the motor shaft with a wooden mallet or block.

(f) The rear end-bell is removed from the housing in the same way as the front end-bell.

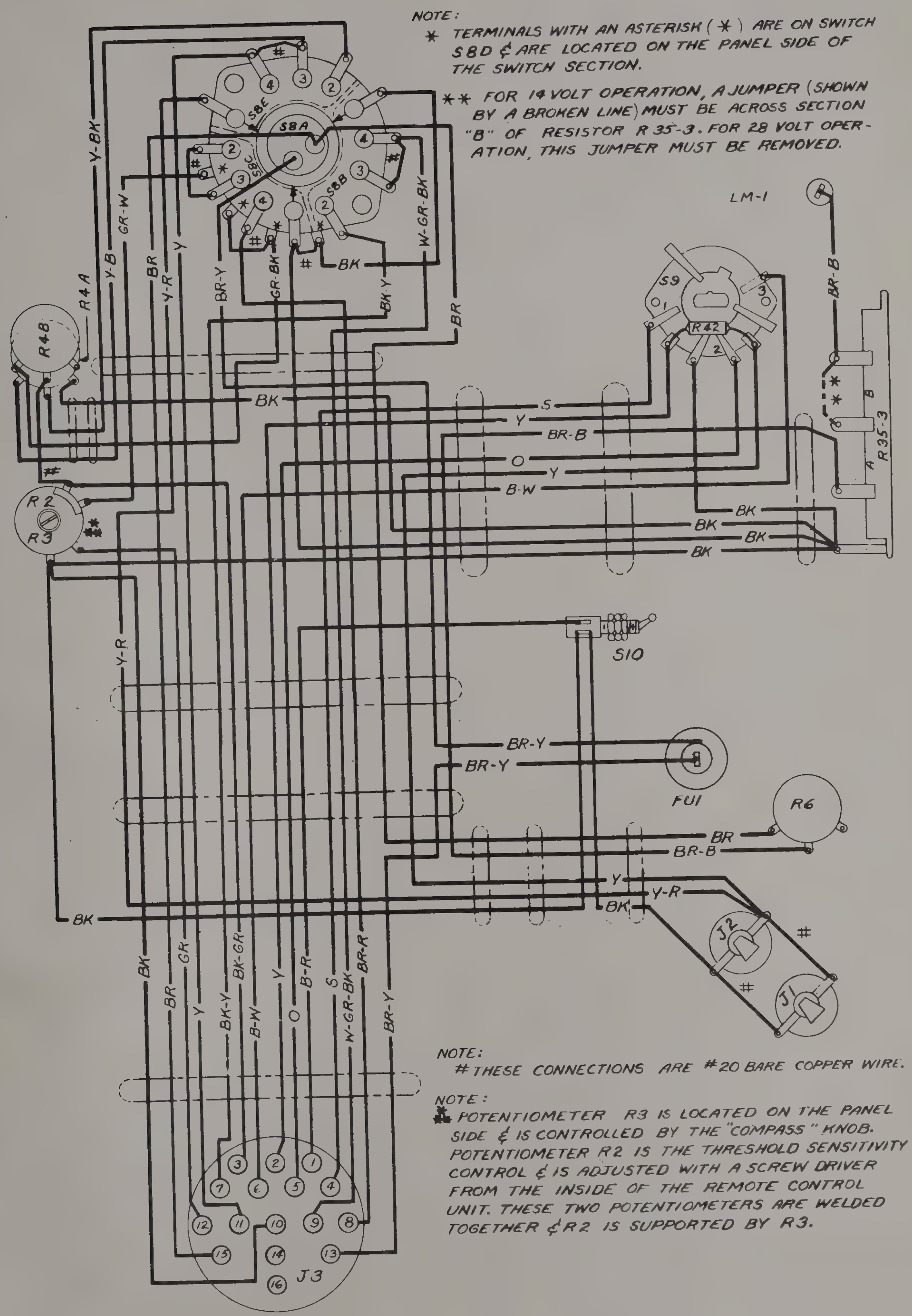


Figure 45—Types MN-28C, MN-28NA, and MN-28Y Remote Controls, Wiring Diagram

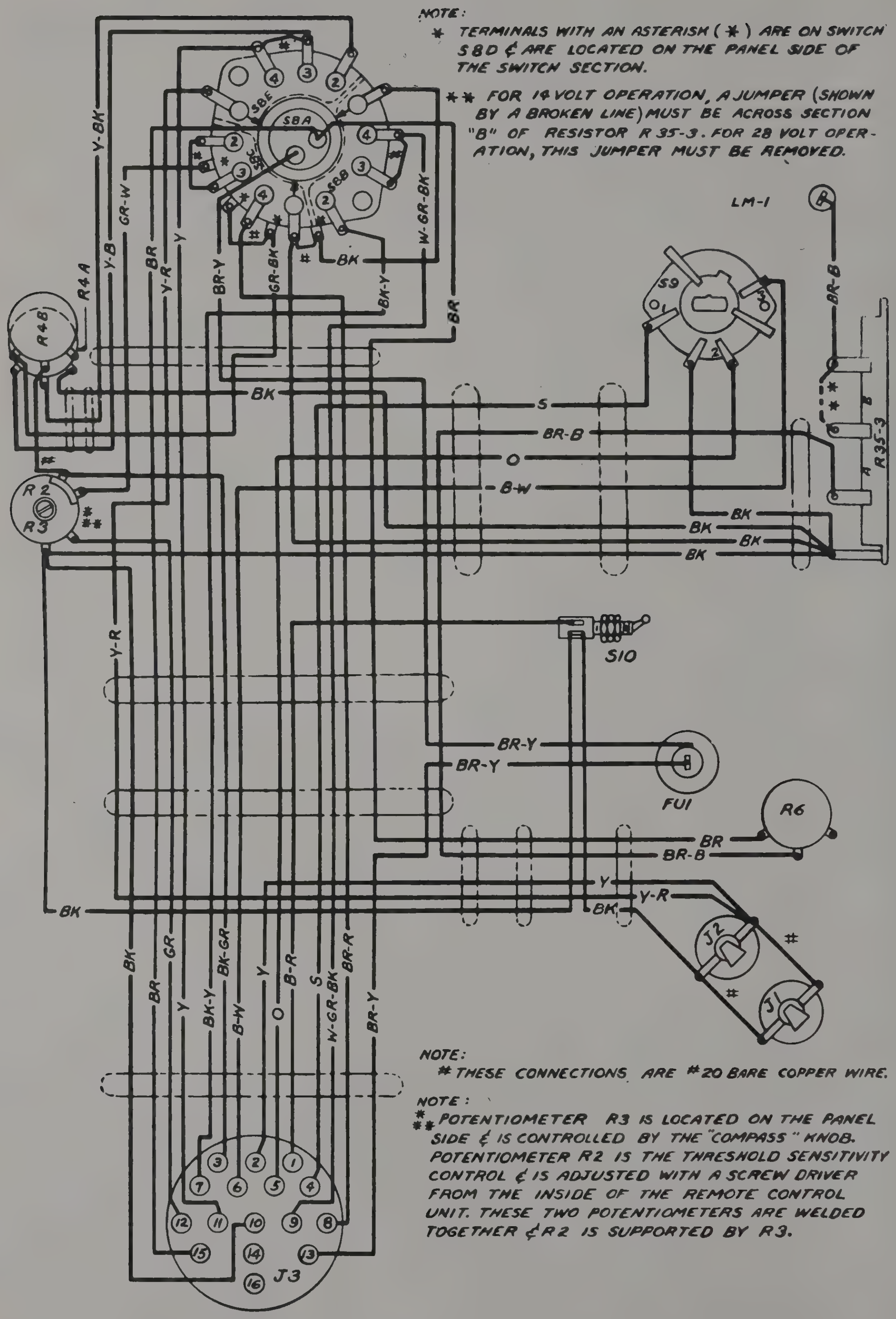


Figure 46—Types MN-28G and MN-28X Remote Controls, Wiring Diagram

(g) In reassembling the motor, mount the brush holders in the rear end-bell (if they had been removed) and press the end-bell onto the housing. Make sure that the notch in the rim of the end-bell engages the positioning stud in the housing. Next, set the armature in place and tap lightly to seat the rear housing. Apply glyptal cement to all screws. Press the front end-bell in place, with the notch in the rim in line with the positioning stud and draw up tightly by means of the two frame screws. Reassemble the brushes, making certain that the brush marked "+" is mounted in the brush holder marked "+", and that both brushes are mounted with the markings on the brush facing the markings on the end-bell. Replace the brush retaining screws, being careful not to twist the brush wires. Replace the worm on the motor shaft. Resolder the wires to the proper terminal of the wafer switch S5. Secure the motor to the drive assembly.

g. REMOVAL OF OUTPUT TRANSMITTERS T15 AND T16.—Unsolder the leads from the terminals and remove the screws which secure them to the chassis. These assemblies are potted and must not be opened. The screws are shown in figure 44 as u, v, w, and x for audio output transformer T15, and as y, z, aa and ab for compass output transformer T16. The leads are as follows:

(1) AUDIO OUTPUT TRANSFORMER T15.

Transformer Terminal No.	*Wire Color*	*Wire Connects to*
1	Blue	V11 term. 3
2	Orange-Red	V11 term. 4
3	Yellow*	TB2 term. 36*
4	No connection*	
5	Red-Green	T16 term. 5
	Red-Green	L8 (in hash filter)
6	Black	V2 ground lug

* For low impedance (600Ω) output. If receiver is wired for high impedance (2000Ω) output. the yellow wire connects to terminal 4 and no connection is made to terminal 3.

(2) COMPASS OUTPUT TRANSFORMER T16.

Transformer Terminal No.	*Wire Color*	*Wire Connects to*
1	Blue-Red	V12 term. 3
2	Red	TB1 term. 58
	Red**	T16 term. 6**
3	Black	V10 ground lug
4	Yellow-Green	J4 term. 21
5	Red-Green	J4 term. 10
	Red-Green	T15 term. 5
6	Red	C10-2

** Jumper between terminals 2 and 6 of compass output transformer T16.

h. REMOVAL OF I-F TRAP L2, L3.—Unscrew the nuts on the spade lugs and remove shield can (ag, and aj of fig. 44). Unsolder the leads from the terminals and remove the two screws holding the assembly to the chassis (ah and ai of fig. 44). The following table lists the connection to the i-f trap L2, L3:

Trap Terminal No.	*Wire Color*	*Wire Connects to*
1	Black-Orange	V5 term. 8
2	Black-White	TB2 term. 19
	Black-White	TB1 term. 10
3	Black-Red	TB2 term. 12
	Black-Red	TB1 term. 9
4	Black-Green	V4 term. 8

In reassembling, do not tighten the screws holding the assembly until the shield can has been mounted and the nuts on the spade lug brought up tight.

i. REMOVAL OF TRANSFORMERS T13 AND T14.—Unsolder the leads from the terminals and remove the nuts which secure them to the chassis. The nuts are shown in figure 44 as ac, and ad for the second i-f transformer T14 and ae, and af for the first i-f transformer T13. The leads are as follows:

(1) FIRST I-F TRANSFORMER T13.

Transformer Terminal No.	*Wire Color*	*Wire Connects to*
1	Blue	V6 term. 3
2	White-Green-Black	T14 term. 6
3	Black	V7 ground lug
4	Red-Green	TB1 term. 22
6	Black*	T13 term. 3*

* Jumper between terminals 3 and 6 of transformer T13.

(2) SECOND I-F TRANSFORMER T14.

Transformer Terminal No.	*Wire Color*	*Wire Connects to*
1	Blue-White	V10 term. 5
2	Blue-Orange	V10 term. 4
3	Red-Green	TB1 term. 29
4	Blue	V8 term. 3
5	Black-Red	V10 term. 8
6	White-Green-Black	T13 term. 2
	White-Green-Black	R14-9
7	Black	V8 ground lug

j. REMOVAL OF PHASER.—Unsolder leads from terminals and remove screws which secure the phaser to the chassis (ak, and al of fig. 44). The leads are as follows:

Phaser Terminal No.	*Wire Color*	*Wire Connects to*
1	Red-White Red-White	TB2 term. 6 TB1 term. 3
2	Green	V3 term. 5
3	Green-White Green-White	TB2 term. 10 TB1 term. 47
4	Green-Black Green-Black	TB2 term. 9 TB1 term. 44
5	Green	V3 term. 4
6	Blue	V1 term. 3

k. REMOVAL OF BFO COIL ASSEMBLY L6.—Unsolder the lead from terminals and remove the two screws which secure the beat-frequency-oscillator coil assembly to the chassis. The screws are located on the top of the chassis near the OSCILLATOR can and the stencil "V7 6J5". The center screw is the iron core adjustment screw and **should not be turned.** The leads are as follows:

L6 Terminal No.	*Wire Color*	*Wire Connects to*
1	Green	V9 term. 5
2	C3-20* Blue-Red	Through C3-20 to V9 ground lug* TV1 term. 66
3	Black-Red	V9 term. 8

* One lead of capacitor C3-20 connects to L6, term. 2, and the other connects to the ground lug of V9.

When this coil assembly is removed the following jumper, resistor, and capacitors are connected to the terminal lugs:

(1) Capacitor C34-5 connected between terminals 2 and 4.

(2) Jumper connected between terminals 4 and 5.

(3) Capacitor C21-5 and resistor R12-14 connected between terminals 5 and 6.

(4) Jumper connected between terminals 1 and 6.

l. REMOVAL OF VARIABLE CAPACITOR ASSEMBLY.—Unsolder the leads, remove the gear box assembly and remove the three nuts which secure the variable capacitor assembly to the chassis. The nuts are shown in figure 44, as am, an and ap.

m. TYPE MN-22A AZIMUTH INDICATOR DISASSEMBLY AND MAINTENANCE. (See fig. 27.)—Disassembly of certain parts may be accomplished as follows:

(1) Remove the dial rotating knob from its shaft by loosening the two Bristo set screws.

(2) To remove the pointer shaft drive gear, uncouple the spring and loosen the two Bristo set screws. This will permit disassembly of the pointer assembly and the worm gear to which the cross slide assembly is attached. Before the crews are loosened, set the pointer on zero and carefully scribe a line on the pointer shaft drive gear and on the cross slide, so that these three parts can be reassembled without changing their relative positions; otherwise, a shift in the error correction will occur. To check for proper assembly, set the cam follower pin at the zero degree (0°) radial line on the cam blank; the pointer should read zero (0) degrees on the dial, when the distance between the center of the shaft and the inside edge of the cam follower pin measures 1.062 inches. In making this check with an unfiled cam, the pointer should read 20° when the cam follower pin is set at the 0° radial line on the cam. In reassembling the pointer shaft drive gear, set the gear so that the pointer shaft has approximately 0.003 inch end play.

(3) Excessive back lash between the worm and worm gear can be remedied by loosening the four screws around the one tachshaft coupling and adjusting same for proper clearance.

(4) Excessive play between the cross slide and its rollers can be corrected by loosening two of the screws securing the roller brackets and setting the rollers up against the cross slide.

(5) Lubrication at 1000 hour intervals is recommended as follows: Apply a small amount of light oil on the cross slide rollers, pointer shaft drive gear, and the bearing for the worm gear. The ball bearings on the worm shaft should require no lubrication. Apply Royco #6A grease to the worm and to the edge of the cam.

n. TYPE MN-40D AZIMUTH INDICATOR DISASSEMBLY AND MAINTENANCE. (See fig. 26.)—To gain access to the mechanism, proceed as follows:

(1) Remove the four screws in the back of the mounting plate, and lift off this plate.

(2) Remove the four screws thus exposed in the cam housing assembly, and lift off this assembly.

(3) If an attempt has been made to apply more than 20 degrees aircraft error correction, the cam strip may be bent, causing jumpy pointer action. If this is the case, return all adjusting screws toward their zero correction positions, being care-

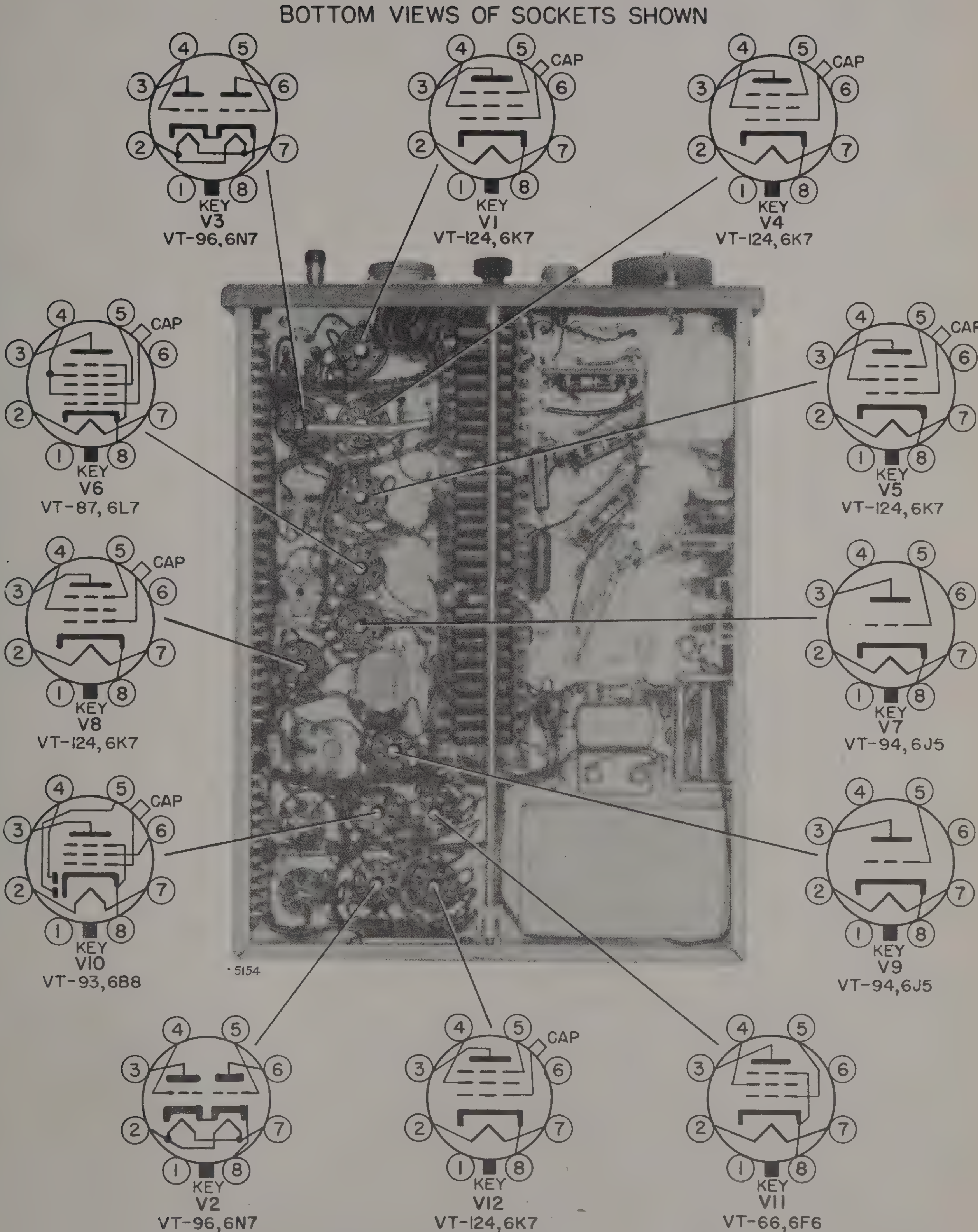


Figure 47—Type MN-26 Radio Compass, Tube Socket Location Diagram*

ful to proceed in a manner which reduces the stress at all positions proportionately. If with no correction applied, the cam strip still is kinked or uneven, it will be necessary to install a new cam strip. This is a rather difficult operation and should be performed **only** when proper tools are available.

(4) The compensator should slide freely and return to rest in the extended position shown in figure 26. The cam strip roller and the guide rollers should revolve very freely.

(5) There should be a minimum of backlash in the worm drive, and the worm shaft should not bind.

(6) The outer dial should rotate smoothly, but have sufficient friction to prevent its rotation with vibration.

6. VACUUM TUBE SOCKET VOLTAGE MEASUREMENTS.

Battery voltage, 28-volt. Function switch in "COMP." position. Threshold sensitivity "COMPASS," loop gain and "AUDIO" controls are fully clockwise. Band switch on Band III. All voltages are measured to the chassis unless otherwise stated. Allowable tolerance of the voltage variation ±10%. Measurements made with a 5000 ohms per volt d-c voltmeter. Plate and screen voltages measured on 250-volt scale. Heater, suppressor, and cathode voltages measured on 10-volt scale unless otherwise specified.

Tube	*Socket Terminal*	*Element*	*Voltage*
V1, 6K7	2 to 7	Heater	6.4
Loop Amp.	3	Plate	192.
	4	Screen	97.
	5	Suppressor	2.8
	8	Cathode	2.8
V2, 6N7	2 to 7	Heater	6.5
Audio Osc.	3	Plate (P_2)	200.
	6	Plate (P_1)	200.
	8	Cathode	1.0
V3, 6N7	2 to 7	Heater	6.4
Mod.	3	Plate (P_2)	170.
	6	Plate (P_1)	170.
	8	Cathode	10.
V4, 6K7	2 to 7	Heater	6.6
1st RF	3	Plate	170.
	4	Screen	77.
	5	Suppressor	0.
	8	Cathode	3.0

Tube	*Socket Terminal*	*Element*	*Voltage*
V5, 6K7	2 to 7	Heater	6.4
	3	Plate	175.
	4	Screen	75.
	5	Suppressor	0.
	8	Cathode	3.0
V6, 6L7	2 to 7	Heater	65
1st Det.	3	Plate	1900
	4	Screen	85.0
	5	Grid #3	2.8
	8	Cathode	3.8
V7, 6J5	2 to 7	Heater	6.5
Het. Osc.	3	Plate	62.
	8	Cathode	0.
V8, 6K7	2 to 7	Heater	6.3
IF Amp.	3	Plate	167.
	4	Screen	125.
	5	Suppressor	0.
	8	Cathode	4.7
V9, 6J5	2 to 7	Heater	6.5
CW Osc.	3	Plate	*23.
V10, 6B8	2 to 7	Heater	6.6
2nd Det.	3	Plate	75.
	6	Screen	75.
	8	Cathode	**15.
V11, 6F6	2 to 7	Heater	6.6
Audio Amp.	3	Plate	195.
	4	Screen	210.
	8	Cathode	**13.
V12, 6K7	2 to 7	Heater	6.4
Comp. Amp.	3	Plate	195.
	4	Screen	65.
	5	Suppressor	0.
	8	Cathode	1.4

* CW ON.
** 50 V Scale.

When vacuum tube socket voltages are found to vary appreciably from the typical values given in the above table, the trouble can usually be located as described below:

a. HEATER VOLTAGE HIGH.—Heater burned out in one of the tubes in the same parallel connected group. (See figs. 51 to 54.)

b. HEATER VOLTAGE LOW.—Dirty contacts on S8. Heater burned out in one of the tubes in the other parallel connected group.

c. PLATE VOLTAGE HIGH.—Shorted plate resistor. Open screen or cathode circuit.

d. PLATE VOLTAGE LOW.—Ground on plate lead. Defective screen or cathode by-pass capacitor. Defective plate coupling capacitor.

e. SCREEN VOLTAGE LOW.—Defective screen or cathode by-pass capacitor.

f. CATHODE VOLTAGE HIGH.—Open cathode resistor R2 open. L2 or L3 open.

g. CATHODE VOLTAGE LOW.—Defective cathode by-pass capacitor or resistor.

7. CONTINUITY TEST.

Remove cables and vacuum tubes from Type MN-26* Radio Compass and trace the following circuits with any good ohmmeter. The following tests must result in zero resistance (see fig. 48). Any other reading will indicate a broken or high-resistance connection. Use the wiring diagram (fig. 50) for tracing faulty connections.

From		*To*		*From*		*To*	
Element	*Term.*	*Element*	*Term.*	*Element*	*Term.*	*Element*	*Term.*
J4	3	TB2	37	TB2	9	PHASER	4
J4	3	J4	5	TB2	9	TB1	44
				TB2	10	PHASER	3
J4	10	T16	5	TB2	10	TB1	47
J4	10	T15	5	TB2	11	V3	8
J4	11	TB1	42	TB2	11	TB1	5
J4	12	TB2	36	TB2	12	L2, L3	3
J4	12	T15	3 or 4	TB2	12	TB1	9
J4	13	TB2	38	TB2	13	V4	4
J4	14	TB2	39	TB2	18	V5	4
J4	15	TB2	40	TB2	18	TB1	15
J4	16	TB1	40	TB2	19	L2, L3	2
J4	16	TB2	35	TB2	19	TB1	10
J4	17	TB1	21				
J4	18	TB1	35	TB2	21	V6	8
J4	19	TB1	62	TB2	21	TB1	11
J4	20	TB1	77	TB2	22	TB1	72
J4	21	T16	4	TB2	23	V9	3
J4	23	TB1	39	TB2	23	TB1	20
TB2	6	PHASER	1	TB2	27	V6	4
TB2	6	TB1	3	TB2	27	TB1	12
TB2	7	V1	4				
TB2	7	TB1	85	TB2	29	V8	8
TB2	8	V1	8	TB2	29	TB1	13
TB2	8	V1	5	TB2	30	V8	4
TB2	8	TB1	1	TB2	31	V10	8
TB2	31	T14	5	TB1	58	TB2	15

From		*To*		*From*		*To*	
Element	*Term.*	*Element*	*Term.*	*Element*	*Term.*	*Element*	*Term.*
TB2	31	TB1	53	TB1	61	C7	
TB2	32	V12	4	TB1	66	L6	2
TB2	32	TB1	23				
TB2	33	V12	CAP	TB1	82	R1	
TB2	33	TB1	26				
TB2	34	TB1	43				
TB2	37	TB1	69	V1	3	PHASER	6
TB2	41	V2	5				
TB2	41	TB1	36	V2	1	T15	6
TB2	42	V2	4	V2	2	V3	2
TB2	42	TB1	37	V2	7	V11	2
				V2	7	V10	7
				V2	7	V8	2
TB2	48	TB1	80	V2	7	TB1	68
				V2	7	V5	2
TB1	8	V3	4	V2	7	V4	7
TB1	8	PHASER	5				
TB1	22	T13	4				
TB1	24	V12	8				
TB1	24	V12	5				
TB1	28	V8	4	V3	7	TB1	70
TB1	29	T14	3	V3	7	V7	2
TB1	31	V10	3	V3	7	V6	7
TB1	31	V10	6				
TB1	31	TB1	33	V4	2	V1	7
TB1	38	V11	5				
TB1	45	V2	6	V4	8	L2, L3	4
TB1	46	V2	3				
TB1	48	V2	8				
TB1	58	T16	2	V5	7	V6	2
TB1	58	T16	6	V5	8	L2, L3	1
TB1	58	TB2	50				
TB1	58	TB2	25	V6	3	T13	1
				TB1	7	TB1	82
V7	1	T13	3	TB1	25	TB1	26
V7	1	T13	6	TB1	25	TB1	27
				TB1	33	TB1	34
V7	7	V8	7	TB1	40	TB1	41
				TB1	42	TB1	43

From		To		From		To	
Element	*Term.*	*Element*	*Term.*	*Element*	*Term.*	*Element*	*Term.*
V8	1	T14	7	TB1	49	TB1	50
V8	3	T14	4	TB1	49	TB1	51
				TB1	49	TB1	60
				TB1	49	TB1	63
				TB1	49	TB1	71
V9	5	L6	1	TB1	49	TB1	74
V9	5	L6	6	TB1	49	TB1	86
V9	6	V10	5	TB1	52	TB1	53
V9	6	T14	1	TB1	54	TB1	58
V9	7	V10	2	TB1	54	TB1	59
V9	8	L6	3	TB1	56	TB1	38
				TB1	64	TB1	65
V10	1	T16	3	TB1	67	TB1	83
V10	4	T14	2	TB1	67	TB1	84
				TB1	75	TB1	76
V11	3	T15	1	TB1	75	TB1	77
V11	4	CIO-1		TB1	75	TB1	78
V11	4	T15	2	TB1	79	TB1	80
V11	7	V12	2	TB1	79	TB1	81
				TB2	13	TB2	59
V12	3	T16	1	TB2	26	TB2	27
				TB2	14	TB2	16
				TB2	14	TB2	17
T13	2	T14	6	TB2	22	TB2	24
TB1	2	TB1	3				
TB1	4	TB1	5				
TB1	4	TB1	6				

The following terminals must measure zero resistance to ground (chassis):

Element	*Term.*	*Element*	*Term.*	*Element*	*Term.*	*Element*	*Term.*
TB2	43	TB2	58	TB2	44	V6	1
TB2	44	TB2	61	TB1	71	V7	1
TB2	45	TB2	62	J4	6	V7	8
TB2	46	TB2	63	V1	1	V8	1
TB2	47	TB2	64	V1	2	V8	5
TB2	49	TB2	65	V2	1	V9	1
TB2	52	TB2	66	V3	1	V9	2
TB2	53	TB2	67	V4	1	V10	1
TB2	54	TB2	68	V4	5	V11	1
TB2	56	TB2	20	V5	1	V12	1
TB2	57	TB2	28	V5	5	V12	7
						J7	3

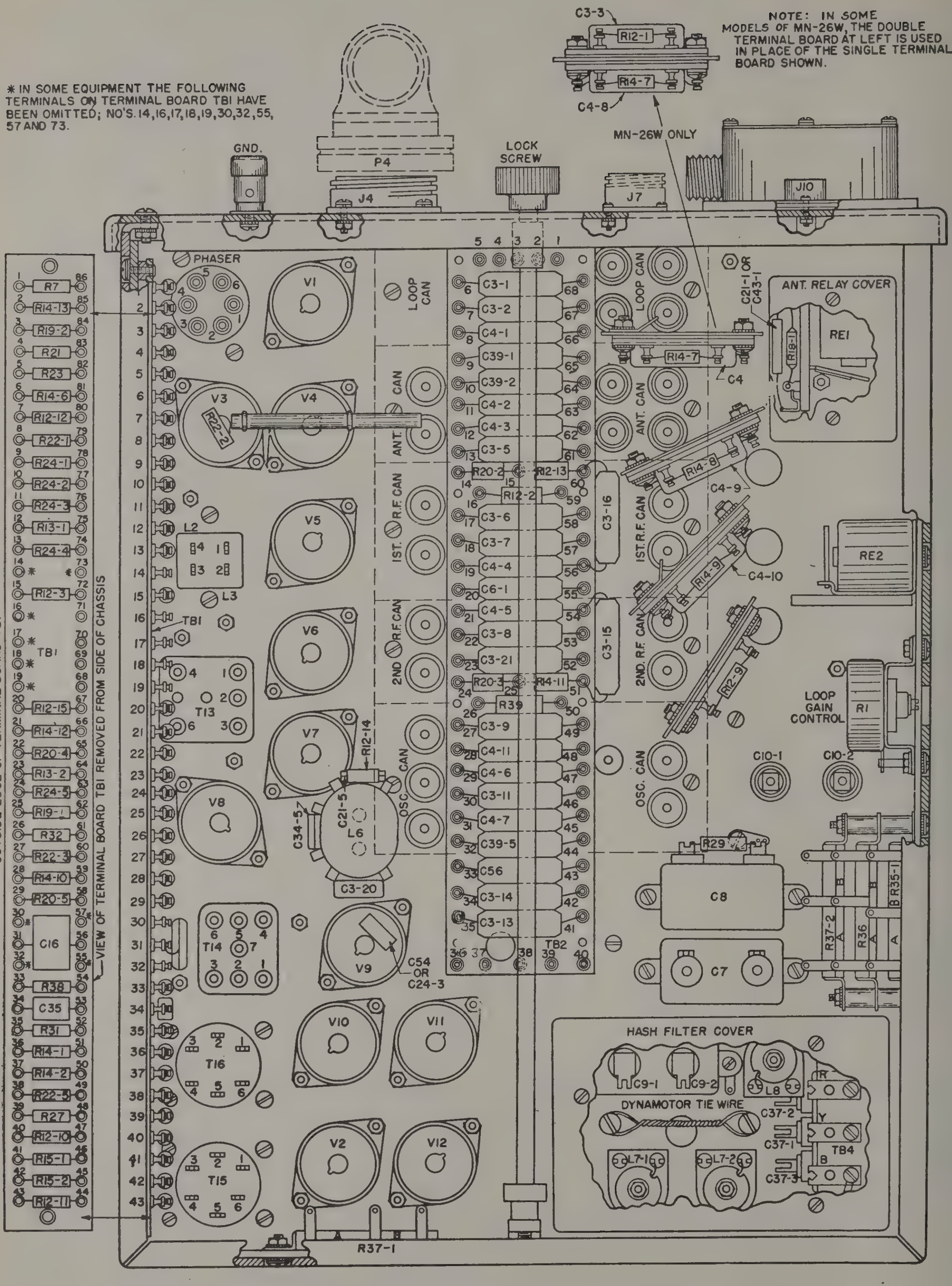


Figure 48—Type MN-26 Radio Compass, Continuity Test Diagram*

The following resistance values must check within ±10%: The ohmmeter scale used is unimportant.

From	*To*	*Resistance (Ohms)*
PHASER term 2	GROUND	500,000
PHASER term 1	PHASER term 6	75
PHASER term 6	PHASER term 2	OPEN
PHASER term 6	PHASER term 3	OPEN
PHASER term 6	PHASER term 4	OPEN
PHASER term 6	PHASER term 5	OPEN
L6 term 2	GROUND	OPEN
L6 term 3	L6 term 4	7
L6 term 4	L6 term 5	0
L6 term 3	L6 term 2	0.5
L6 term 1	L6 term 2	OPEN
L6 term 1	L6 term 6	0
L6 term 5	L6 term 6	100,000
TB2 40	GROUND	OPEN
TB2 39	GROUND	9
TB2 38	GROUND	9
TB2 37	GROUND	5
TB2 36	GROUND	120
L2 term 3	L2 term 4	1
L3 term 1	L3 term 2	1
T13 term 1	T13 term 6	OPEN
T13 term 3	T13 term 6	0
T13 term 1	T13 term 4	10
T13 grid cap	T13 term 2	100,000
T13 grid cap	T13 term 3	OPEN
T14 term 4	GROUND	5,500
T14 term 4	T14 term 2	500,000
T14 term 4	T14 term 7	5,500
TB2 term 15	OSCILLATOR can term B+	50,000
TB2 term 16	TB2 term 59	100,000
TB2 term 26	TB2 term 50	25,000
OSCILLATOR can term GRID	V7 term 5	0
OSCILLATOR can term P	V7 term 3	0
OSCILLATOR can term INJ. G	V6 term 5	0
RADIO FREQ.-2 can term P	V5 term 3	0

From	*To*	*Resistance (Ohms)*
RADIO FREQ.-1 can term P	V4 term 3	0
ANTENNA can term P (rear)	V3 term 3	0
ANTENNA can term P (front)	V3 term 6	0
LOOP can term GND	GROUND	0
LOOP can term COND	C2-1 stator	0
ANTENNA can term B+	TB2 term 60	0
ANTENNA can term COND	C2-2 stator	0
RADIO FREQ.-1 can term COND	C2-3 stator	0
RADIO FREQ.-2 can term COND	C2-4 stator	0
OSCILLATOR can term GND	GROUND	0
OSCILLATOR can term COND	C2-5 stator	0
V11 term 8	GROUND	500
T14 term 2	T14 term 6	100,000
T14 term 1	T14 term 5	300,000
T14 grid cap	T14 term 5	350,000
T16 term 1	T16 term 2	2,700
T16 term 6	T16 term 2	0
T16 term 6	T16 term 5	300
T16 term 4	T16 term 3	13
T15 term 1	T15 term 2	500
T15 term 2	T15 term 5	300
T15 term 6	T15 term 3	120
T15 term 6	T15 term 4	300
T15 term 6	T15 term 5	220
V2 term 7	GROUND	75.6
V12 term 2	GROUND	12.6
T14 term 6	RADIO FREQ.-2 can term AVC	50,000
T14 term 6	RADIO FREQ.-1 can term AVC	50,000
T14 term 6	ANTENNA can term AVC	50,000
T14 term 6	TB2 term 55	0
J10	ANTENNA can term ANT	0

From	*To*	*Resistance (Ohms)*
J10	GROUND	1,000,000
J4 term 9	GROUND	100
J7 term 1	LOOP can term LOOP	0
J7 term 5	LOOP can term LOOP	0
TB2 term 60	ANTENNA can term B+	0
TB2 term 60	TB2 term 15	100,000
TB2 term 15	RADIO FREQ.-1 can term B+	5,000
TB2 term 15	RADIO FREQ.-2 can term B+	5,000
TB1 term 43	TB1 term 44	100,000
TB1 term 45	TB1 term 42	2,000
TB1 term 46	TB1 term 41	2,000
TB1 term 47	TB1 term 40	100,000
TB1 term 48	TB1 term 39	100
TB1 term 49	TB1 term 38	500,000
TB1 term 50	TB1 term 37	50,000
TB1 term 51	TB1 term 36	50,000
TB1 term 52	TB1 term 35	3,000
TB1 term 53	TB1 term 34	OPEN
TB1 term 54	TB1 term 33	25,000
TB1 term 56	TB1 term 31	500,000
TB1 term 58	TB1 term 29	5,000
TB1 term 59	TB1 term 28	50,000
TB1 term 60	TB1 term 27	500,000
TB1 term 61	TB1 term 26	300,000
TB1 term 62	TB1 term 25	1,000
TB1 term 63	TB1 term 24	600
TB1 term 64	TB1 term 23	150,000
TB1 term 65	TB1 term 22	5,000
TB1 term 66	TB1 term 21	50,000
TB1 term 67	TB1 term 20	100,000
TB1 term 72	TB1 term 15	100,000
TB1 term 74	TB1 term 13	600
TB1 term 75	TB1 term 12	150,000
TB1 term 76	TB1 term 11	600
TB1 term 77	TB1 term 10	600
TB1 term 78	TB1 term 9	600
TB1 term 79	TB1 term 8	500,000
TB1 term 80	TB1 term 7	Vary with rotation of R1
TB1 term 81	TB1 term 6	
TB1 term 82	TB1 term 5	
TB1 term 83	TB1 term 4	
TB1 term 84	TB1 term 3	1,000
TB1 term 85	TB1 term 2	50,000
TB1 term 86	TB1 term 1	300

8. OVERALL PERFORMANCE CHARACTERISTICS.

a. GENERAL.—If at any time operation of the equipment is questionable, measure the performance in accordance with the following typical procedures and values. After making any major repairs or adjustments, measure the performance to insure that the adjustments have been properly made.

b. STANDARD TEST CONDITIONS.—For these tests the following conditions should be maintained unless otherwise stated:

(1) SIGNAL-TO-NOISE RATIO.—4 to 1 in power, 2 to 1 in voltage. The noise output is 12.5 milliwatts when standard output is 50 milliwatts or 7 volts when standard output is 14.1 volts.

(2) STANDARD OUTPUT.—50 milliwatts or 14.1 volts (signal and noise). This output may be obtained from either of the remote control unit jacks with plug out of the other jack. On receiver operation adjust AUDIO control for standard signal-to-noise ratio. On COMP. adjust AUDIO control for maximum output.

(3) ARTIFICIAL ANTENNA. — Receiver 100 mmf, compass 100 mmf, and one-half meter effective height.

(4) STANDARD MODULATION SIGNAL. —30%, 400 cycles per second.

(5) WARM UP PERIOD.—20 minutes.

(6) LOW VOLTAGE SUPPLY—+28 volts.

c. SENSITIVITY: "REC. ANT."—Apply the standard modulated signal to the antenna terminal through an artificial antenna. Set generator output at approximately 5 microvolts. Carefully tune the radio compass unit to resonance. Cut off modulation, leaving the carrier on. Set AUDIO control to obtain 12.5 milliwatts average noise output. Turn modulation on and set generator output to the value which gives 50 milliwatts receiver output. Turn off modulation and reset AUDIO control to obtain 12.5 milliwatts average noise output. Repeat until 50 milliwatts output is obtained with modulation on and 12.5 milliwatts noise with modulation off. Repeat above procedure for each test frequency. Record receiver input on a form similar to that contained in paragraph 8b(1) above.

d. MINIMUM NOISE LEVEL.—Measure minimum noise level by turning function switch REC. ANT. and turning AUDIO control to minimum. Output levels greater than 0.050 milliwatts indicate trouble in dynamotor, filtering, or second detector and audio circuits.

e. INTERMEDIATE FREQUENCY REJECTION RATIO.—Measure "REC. ANT." sensitivity at test frequency (150 kc or 200 kc). Set signal generator at point of greatest response near 112.5 kc

MINIMUM PERFORMANCE DATA

Paragraph Reference Number	Compass Type Number	MN-26A MN-26C MN-26CA MN-26Y			MN-26M MN-26W MN-26X			MN-26A MN-26C MN-26CA MN-26Y			MN-26M MN-26W MN-26X			MN-26A MN-26C MN-26CA			MN-26W MN-26X			MN-26M MN-26Y		
	Test Point	Band I			Band I			Band II			Band II			Band III			Band III			Band III		
		Low	Med.	High	Low	Med.	High	Low	Med.	High	Low	Med.	High	Low	Med.	High	Low	Med.	High	Low	Med.	High
	Test Freq. (kilocycles)	100	220	325	200	300	410	325	470	695	410	600	850	695	1100	1500	850	1200	1750	3400	4000	7000
8c	Rec. Ant. Sensitivity (MV)	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	8	8	8
8e	I-F Rejection Ratio	250M:1			10M:1																	
8f	Image Rejection Ratio															12M:1			6M:1			50M:1
8i	Loop Sensitivity (MV/M)	100			100	100	100	100			100	100	100	100			100					
8j	COMPASS SENSITIVITY, UNIFORMITY, AND ACCURACY ("Compass" Control at Maximum) — 100 MV/M — O	±2°	±2°	±2°	±2°	±2°	±2°	±2°	±2°	±2°	±2°	±2°	±2°	±2°	±2°	±2°	±2°	±2°	±2°			
	100 MV/M — R																					
	100 MV/M — L																					
	1000 MV/M — O	±1°	±1°	±1°	±1°	±1°	±1°	±1°	±1°	±1°	±1°	±1°	±1°	±1°	±1°	±1°	±1°	±1°	±1°			
	1000 MV/M — R	8°	8°	8°	8°	8°	8°	8°	8°	8°	8°	8°	8°	8°	8°	8°	8°	8°	8°			
	1000 MV/M — L	8°	8°	8°	8°	8°	8°	8°	8°	8°	8°	8°	8°	8°	8°	8°	8°	8°	8°			
	100M MV/M — O	±1°	±1°	±1°	±1°	±1°	±1°	±1°	±1°	±1°	±1°	±1°	±1°	±1°	±1°	±1°	±1°	±1°	±1°			
	100M MV/M — R																					
	100M MV/M — L																					
8h	Rec. Ant. Selectivity Res. Input Band Width X1000			12			14			15			17			20			21			23
8g	AVC Action Mod. 80%, Test Freq. 635 Kc	INPUT—Range from 10 microvolts to 1 volt.																				
		OUTPUT—Range of 5 decibels.																				

and increase its output until 50 milliwatts receiver output is obtained. The ratio of the attenuator setting at 112.5 kc and at the test frequency is the rejection ratio. Record this data on a form similar to that contained in paragraph 8(1) above.

NOTE

The harmonics of the signal will appear in the frequency range of the equipment (i. e., 225, 337.5, etc.). To avoid response from harmonics, select a test frequency half-way between these harmonics.

f. IMAGE REJECTION RATIO.—Measure "REC. ANT." sensitivity of equipment first at test frequency and again with a signal generator set 225 kc above the test frequency. Do not disturb tuning of equipment but vary the signal generator frequency slightly until maximum response is obtained. The ratio of the signal generator output of the two settings is the image rejection ratio. Record this data on a form similar to that in paragraph 8b(1), above.

g. AVC ACTION.—Turn function switch to "REC. ANT." and audio control to maximum. Apply a standard modulated signal to the antenna terminal through a 100 mmf artificial antenna. Record milliwatts output against microvolts input on a form similar to that of paragraph 8b(1). The test frequency generally used is 655 kc.

h. SELECTIVITY: "REC. ANT."—Measure "REC. ANT." sensitivity of equipment at the high frequency end of each band. Increase the signal generator attenuator setting so that the output is 1000 times that of the measured sensitivity. Vary signal generator frequency above and below resonance until output equals original test output. Record the band width on a form similar to that of paragraph 8(1).

i. SENSITIVITY: "REC. LOOP."—Mount loop beneath the reference transmission line. Operate on "REC. LOOP." Turn loop for maximum pick-up. Adjust "AUDIO" control for a signal to noise power ratio of 4 to 1 as done for "REC. ANT." sensitivity measurement of paragraph 8c. Record microvolts per meter field strength at the center of the loop for standard receiver output on a form similar to paragraph 8(1).

j. COMPASS SENSITIVITY UNIFORMITY AND ACCURACY.—Mount the loop beneath the reference transmission line. Operate on "COMP." Use a 100 mmf, 0.5 meter artificial antenna (or 50 mmf, 0.25 meter for Types MN-26-M, W, and X). Adjust "COMPASS" control so that approximately 5 to 6 degrees rotation of the loop produces full scale indicator deflection, with an input of 1000 microvolts per meter at the center of the loop. Without changing "COMPASS" control setting, record the degrees rotation of loop required to produce zero and full-scale right and left indicator pointer deflection for 50, 100, and 100,000 microvolts per meter input at different test frequencies on a form similar to that of paragraph 8 l, following.

k. INPUT FOR FULL SCALE INDICATOR DEFLECTION.—This test requires a well-shielded compass test room. Mount loop beneath the reference transmission line, with "COMPASS" control on maximum. Apply an 800 kc signal of 1000 microvolts per meter field strength at the center of the loop. Record number of degrees loop rotation required for left and right full scale indicator deflection. Typical loop settings are 5.5 degrees left for full scale left deflection, 0 for on-course setting, and 5.5 degrees right for full scale right deflection.

SECTION VI
SUPPLEMENTARY DATA

1. TUBE COMPLEMENT.

The vacuum tubes used in Type MN-26* Radio Compass perform the following function:

Ref. No.	*Commercial Type No.*	*Function*
V1	6K7	Loop Amplifier
V2	6N7	Audio Oscillator
V3	6N7	Modulator
V4	6K7	1st R-F Amplifier

Ref. No.	*Commercial Type No.*	*Function*
V5	6K7	2nd R-F Amplifier
V6	6L7	1st Detector
V7	6J5	Heterodyne Oscillator
V8	6K7	I-F Amplifier
V9	6J5	C-W Oscillator
V10	6B8	2nd Detector
V11	6F6	Audio Amplifier
V12	6K7	Compass Amplifier

No other component of the radio compass equipment uses vacuum tubes.

2. SUMMARY:

a. FREQUENCY RANGE.—The frequency range and type of operation is as follows:

(1) TYPES MN-26A, MN-26C, AND MN-26CA RADIO COMPASSES.

Band	*Frequency Range (Kilocycles)*	*Function Switch Position*			
		Visual-Unidirectional Left-Right Indication	*Aural Reception with Loop Antenna*	*Aural-Null Directional Reception*	*Aural Reception with Non-Directional Antenna*
I	150- 325	COMP.	REC. LOOP	REC. LOOP	REC. ANT.
II	325- 695	COMP.	REC. LOOP	REC. LOOP	REC. ANT.
III	695-1500	COMP.	REC. LOOP	REC. LOOP	REC. ANT.

(2) TYPE MN-26M RADIO COMPASS.

Band	*Frequency Range (Kilocycles)*	*Function Switch Position*			
		Visual-Unidirectional Left-Right Indication	*Aural Reception with Loop Antenna*	*Aural-Null Directional Reception*	*Aural Reception with Non-Directional Antenna*
I	200- 410	COMP.	REC. LOOP	REC. LOOP	REC. ANT.
II	410- 850	COMP.	REC. LOOP	REC. LOOP	REC. ANT.
III	3400-7000	NOT AVAILABLE			REC. ANT.

(3) TYPES MN-26W, AND MN-26X RADIO COMPASSES.

Band	*Frequency Range (Kilocycles)*	*Function Switch Position*			
		Visual-Unidirectional Left-Right Indication	*Aural Reception with Loop Antenna*	*Aural-Null Directional Reception*	*Aural Reception with Non-Directional Antenna*
I	200- 410	COMP.	REC. LOOP	REC. LOOP	REC. ANT.
II	410- 850	COMP.	REC. LOOP	REC. LOOP	REC. ANT.
III	850-1750	COMP.	REC. LOOP	REC. LOOP	REC. ANT.

(4) TYPE MN-26Y RADIO COMPASS.

Band	*Frequency Range (Kilocycles)*	*Function Switch Position*			
		Visual-Unidirectional Left-Right Indication	*Aural Reception with Loop Antenna*	*Aural-Null Directional Reception*	*Aural Reception with Non-Directional Antenna*
I	150- 325	COMP.	REC. LOOP	REC. LOOP	REC. ANT.
II	325- 695	COMP.	REC. LOOP	REC. LOOP	REC. ANT.
III	3400-7000	NOT AVAILABLE			REC. ANT.

There are no pre-set frequencies.

b. ANTENNA CHARACTERISTICS.—The nondirectional vertical antenna should have an effective height of one-half meter, a capacity of 100 micromicrofarads, and a resistance between 1 to 10 ohms.

c. POWER REQUIREMENTS.

(1) DYNAMOTOR.—The dynamotor supplies plate voltage to the equipment.

(a) INPUT.—28 volts, 1.6 amperes (or 14 volts, 3.2 amperes).

(b) OUTPUT.—230 volts, 100 milliamperes.

(c) TEMPERATURE RISE.—40 degrees centigrade.

(d) REVOLUTIONS PER MINUTE.—4600 RPM.

(e) DUTY.—Continuous.

(f) MANUFACTURER.—Due to difficulty in procuring large numbers of dynamotors from any one vendor, the Type MN-26* Radio Compass may be supplied with any one of the following.

Manufacturer	*Type Numbers*	
	28 Volt Models	*14 Volt Models*
Bendix	DA-1A	DA-1B
Eicor	ML3415 PS21	ML3415-20
Pioneer	SP125 SS2041	SP125 SS2017

(2) BAND SWITCH MOTOR.

(a) POWER CONSUMPTION.—24 volts, 1.25 amperes (or 12 volts, 2.5 amperes).

(b) MANUFACTURER. — Band switch motors are supplied by three manufacturers as follows:

Manufacturer	*Type Numbers*	
	28 Volt Models	*14 Volt Models*
Pioneer	BX100-W-988	BX100-W-988
Eicor	1610-12	1610-2
Bendix	E11500-1	E11500-2

d. POWER CONSUMTION.—The primary input requirement is normally 28 volts, 3 amperes (or 14 volts, 6 amperes) and when changing bands is 28 volts, 4.25 amperes (or 14 volts, 8.5 amperes).

3. CONVERSION OF EQUIPMENT.

a. CONVERSION FROM 28- TO 14-VOLT OPERATION.—If it is necessary to convert the equipment for use with a 14-volt primary power source in place of the 28-volt for which it is designed, make the following simple changes:

(1) Replace the 28-volt band switch motor with a 14-volt motor.

(2) Replace the 28-volt dynamotor with a 14-volt dynamotor.

(3) Solder a wire jumper across the terminals of resistor R37-2. Resistance should now be zero.

(4) Solder a wire jumper across the B-section (67 ohms) of resistor R35-1. Resistance of R35-1 should now be 50 ohms.

(5) Solder a wire jumper across the B-section (75 ohms) of resistor R36. Resistance of R36 should now be 120 ohms.

(6) Remove the jumper which connects terminals 69 and 70 of terminal board TB1.

(7) Solder a wire jumper across terminals 68 and 69 of terminal board TB1.

(8) Solder a wire jumper across terminals 70 and 71 of terminal board TB1.

(9) Clearly mark the revised radio compass to indicate that it is to be used on a 14-volt source.

(10) Solder a wire jumper across the B section (67 ohms) of resistor R35-1. Resistance should should now be 50 ohms.

(11) Clearly mark the revised remote control unit to indicate that it is to be used on a 14-volt source.

b. CONVERSION FROM 14- to 28-VOLT OPERATION.—Reverse the procedure described in paragraph 3a above.

c. CONVERSION OF EQUIPMENT FOR HIGH IMPEDANCE OUTPUT.—If it is desirable to convert the equipment from low impedance (600 ohms) output to high impedance (4000 ohms) output, make the following simple changes:

(1) TYPE MN-26* RADIO COMPASS.—Unsolder the yellow wire from terminal 3 and solder it to terminal 4 of transformer T15.

(2) TYPE MN-28 REMOTE CONTROL.—Replace "AUDIO" control (R4A and R4B) L72704-1 with A14550. Mark the revised remote control to indicate that this change has been made.

d. CONVERSION TO AUTOMATIC COMPASS OPERATION.—The left-right manual compass described in this book may be converted for automatic compass operation with the addition of units, and by converting the Type MN-26* Radio Compass.

4. SUMMARY OF OPERATION.

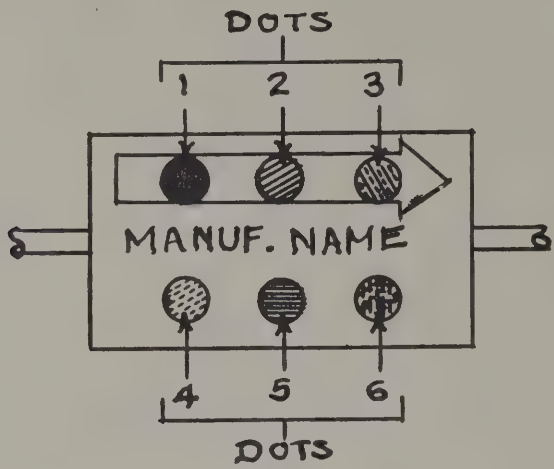
The following table lists the positions of controls for the various functions of the equipment:

SUMMARY OF OPERATION

Function of Equipment / Position of Controls	Homing			Direction Finding		Radio Reception	
	Radio Range	*Visual (Radio Compass)*	*Aural-Null*	*Visual Bearings*	*Aural-Null Bearings*	*With Non-Directional Antenna*	*With Loop (Anti-Rain-Static)*
MN-28 Function switch	"REC. ANT."	"COMP."	"REC. LOOP"	"COMP."	"REC. LOOP"	"REC. ANT."	"REC. LOOP"
MN-28 "COMPASS" control	Not Used	Maximum	Not Used	Adjust for desired IN-4A sensitivity	Not Used	Not Used	Not Used
MN-28 "AUDIO" control	Adjust for desired volume	As desired	Adjust for desired width of null	As desired	Adjust for desired width of null	Adjust for desired volume	Adjust for desired volume
MN-28 C.W. "ON-OFF"	As desired	As desired	"ON"	As desired	"ON"	As desired	As desired
MR-15A Crank Drive	Not Used	Rotate for zero (0) reading of MN-22A or MN-40D	Rotate for zero (0) reading of MN-22A or MN-40D	Rotate for on-course indication on IN-4A	Rotate for minimum headset volume	Not Used	Rotate for maximum volume
IN-4A	Not Used	Turn ship in direction indicated until pointer returns to center	Not Used	Rotate MR-15A until pointer returns to center	Not Used	Not Used	Not Used
MN-22A or MN-40D	Not Used	0	0	When on-course correct for aircraft heading read bearing	Read bearing when volume is minimum	Not Used	Not Used

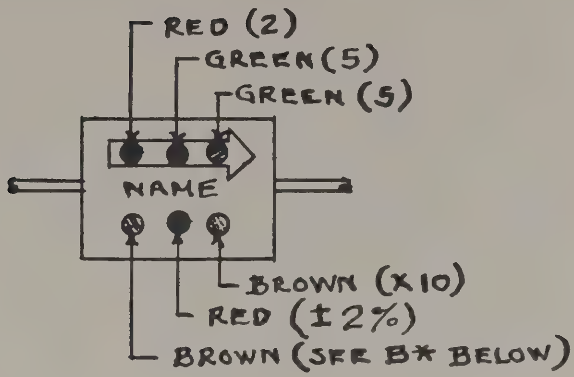
5. CAPACITOR CODE TABLES.

a. AMERICAN WAR STANDARD 6-DOT COLOR CODE CHART FOR CAPACITORS (MOLDED MICA).



Color	1st Dot	2nd Dot	3rd Dot	4th Dot	5th Dot	6th Dot
	1st Digit	2nd Digit	3rd Digit	Decimal Multiplier	Tolerance	See Below*
Black	0	0	0	1	±20%	A*
Brown	1	1	1	10		B*
Red	2	2	2	100	±2%	C*
Orange	3	3	3	1,000		D*
Yellow	4	4	4	10,000		E*
Green	5	5	5	100,000		F*
Blue	6	6	6	1,000,000		G*
Violet	7	7	7	10,000,000		
Gray	8	8	8	100,000,000		
White	9	9	9	1,000,000,000		
Gold				0.1	±5%	
Silver				0.01	±10%	

Values are in micro-microfarads.



Example

2550 micromicrofarads; ±2%; mica-dielectric; low-loss case.
Significance of 6th dot;

A*—Ordinary Mica By-Pass

B*—Same as A*—Low-loss case

C*—By-Pass or Silver Mica Capacitor (±200% parts/million/C)

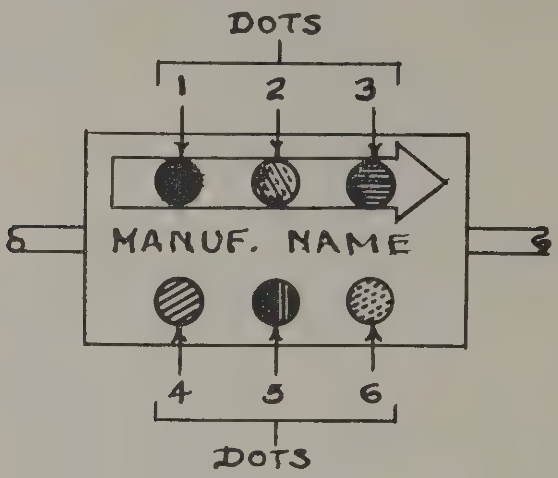
D*—Silver Mica Capacitor (±100 parts/million/C)

E*—Silver Mica Capacitor (0 to +100 parts/million/C)

F*—Silver Mica Capacitor (0 to +50 parts/million/C)

G*—Silver Mica Capacitor (0 to +50 parts/million/C)

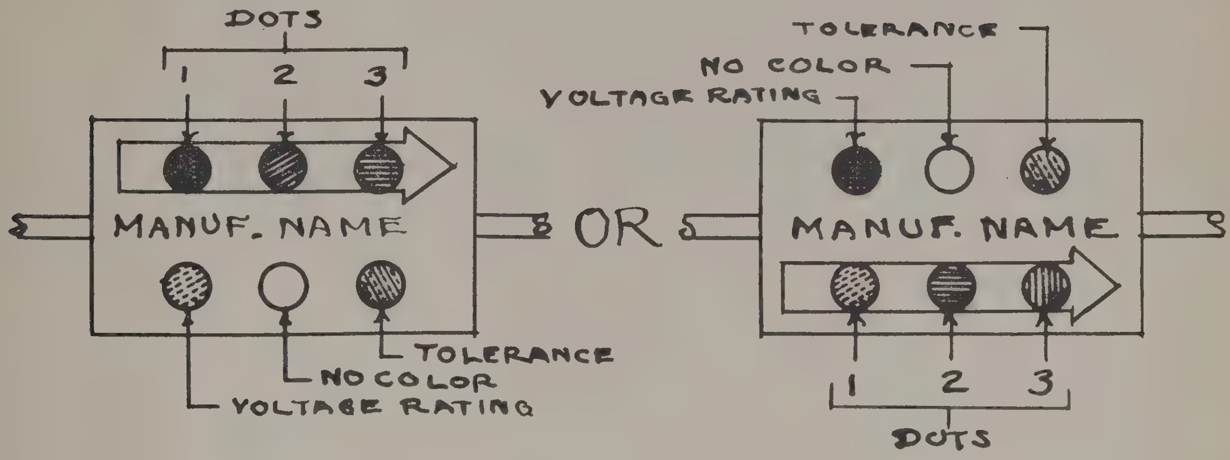
b. RMA STANDARD 6-DOT COLOR CODE CHART FOR CAPACITORS.



Color	1st Dot	2nd Dot	3rd Dot	4th Dot	5th Dot	6th Dot
	1st Digit	2nd Digit	3rd Digit	Decimal Multiplier	Tolerance	Voltage
Black	0	0	0	1		
Brown	1	1	1	10	1%	100v
Red	2	2	2	100	2%	200v
Orange	3	3	3	1,000	3%	300v
Yellow	4	4	4	10,000	4%	400v
Green	5	5	5	100,000	5%	500v
Blue	6	6	6	1,000,000	6%	600v
Violet	7	7	7	10,000,000	7%	700v
Gray	8	8	8	100,000,000	8%	800v
White	9	9	9	1,000,000,000	9%	900v
Gold				0.1		1,000v
Silver				0.01	10%	2,000v
Body					20%	500v

Values are in micro-microfarads.

c. THREE-DOT COLOR CODE CHART FOR CAPACITORS.

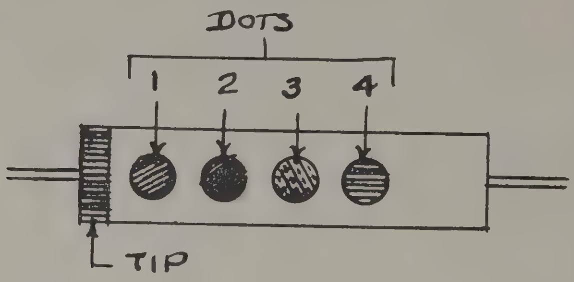


Color	1st Dot 1st Digit	2nd Dot 2nd Digit	3rd Dot Decimal Multiplier	Tolerance	Voltage
Black	0	0	1		
Brown	1	1	10	1%	100v
Red	2	2	100	2%	200v
Orange	3	3	1,000	3%	300v
Yellow	4	4	10,000	4%	400v
Green	5	5	100,000	5%	500v
Blue	6	6	1,000,000	6%	600v
Violet	7	7	10,000,000	7%	700v
Gray	8	8	100,000,000	8%	800v
White	9	9	1,000,000,000	9%	900v
Gold			0.1		1000v
Silver			0.01	10%	2000v
Body				20%	*

Values are in micro-microfarads.

* When no color is indicated the voltage rating may be as low as 300 volts.

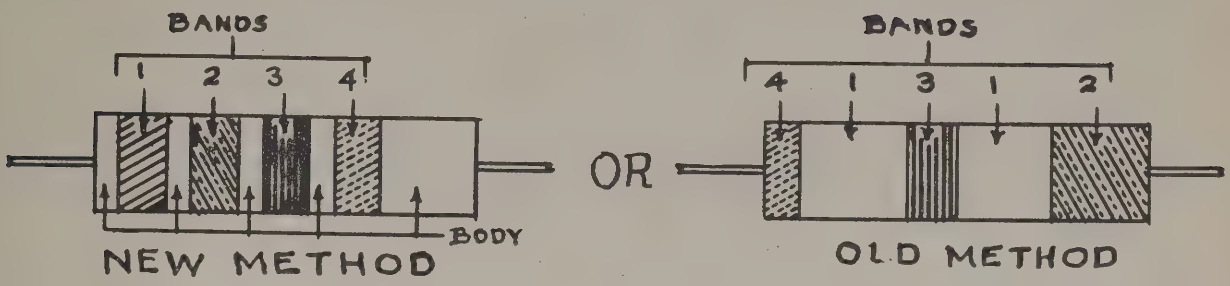
d. COLOR CODE CHART FOR TUBULAR CERAMIC CAPACITORS.



Color	Tip Temperature Coefficient	1st Dot 1st Digit	2nd Dot 2nd Digit	3rd Dot Decimal Multiplier	4th Dot Tolerance
Black	0	0	0	1	
Brown	.00003 Neg.	1	1	10	1%
Red	.00008 Neg.	2	2	100	2%
Orange	.00015 Neg.	3	3	1,000	3%
Yellow	.00022 Neg.	4	4	10,000	4%
Green	.00033 Neg.	5	5	100,000	5%
Blue	.00047 Neg.	6	6	1,000,000	6%
Violet	.00075 Neg.	7	7	10,000,000	7%
Gray		8	8	0.1	
White		9	9	0.01	10%

Values are in micro-microfarads.

e. RMA COLOR CODE CHART FOR RESISTORS.



Color	*1st Band*	*2nd Band*	*3rd Band*	*4th Band*
	1st Digit	*2nd Digit*	*Decimal Multiplier*	*Tolerance*
Black	0	0	1	
Brown	1	1	10	
Red	2	2	100	
Orange	3	3	1,000	
Yellow	4	4	10,000	
Green	5	5	100,000	
Blue	6	6	1,000,000	
Violet	7	7	10,000,000	
Gray	8	8	100,000,000	
White	9	9	1,000,000,000	
Gold				±5%
Silver				±10%
No Color				±20%

Values are in ohms.

In the new types, the body color indicates resistance material as follows: Black—Composition, Non-insulated—Tan, Olive, or White—Composition, Insulated Dark Brown—Wire-wound, Insulated.

SECTION VII
TABLE OF REPLACEABLE PARTS

MODEL: MN-26* RADIO COMPASS EQUIPMENT PART I MAJOR UNIT: TYPE MN-26* RADIO COMPASS

Reference Symbol	*Army Stock No. Navy Type No. British Ref. No.*	*Name of Part and Description*	*Function*	*Mfr. and Designation*	*Drawing or Spec. No.*
C1-1	3D9006V-3	CAPACITOR: Variable; 6 to 25 mmf, ±10%; 500 volts dcw; air dielectric, right hand terminal. Mounted in LOOP can.	Loop Trimmer, Band 1	Hammarlund type APC special	QB7751-25
C1-2		Same as C1-1. Mounted in LOOP can.	Loop Trimmer, Band 2		
C1-4		Same as C1-1. Mounted in ANTENNA can.	Ant. Trimmer, Band 1		
C1-5		Same as C1-1. Mounted in ANTENNA can.	Ant. Trimmer, Band 2		
C1-6		Same as C1-1. Mounted in ANTENNA can.	Ant. Trimmer, Band 3		
C1-7		Same as C1-1. Mounted in RADIO FREQ.-1 can.	1st r-f Trimmer, Band 1		
C1-8		Same as C1-1. Mounted in RADIO FREQ.-1 can.	1st r-f Trimmer, Band 2		
C1-9		Same as C1-1. Mounted in RADIO FREQ.-1 can.	1st r-f Trimmer, Band 3		
C1-10		Same as C1-1. Mounted in RADIO FREQ.-2 can.	2nd r-f Trimmer, Band 1		
C1-11		Same as C1-1. Mounted in RADIO FREQ.-2 can.	2nd r-f Trimmer, Band 2		
C1-12		Same as C1-1. Mounted in RADIO FREQ.-2 can.	2nd r-f Trimmer, Band 3		
C1-13	3D9006V-3.1	Same as C1-1 except left-hand terminal mounted in OSCILLATOR can.	H-f Osc. Trimmer, Band I	Hammarlund	QB7783-25
C1-14		Same as C1-13, mounted in OSCILLATOR can.	H-f Osc. Trimmer, Band II		
C1-15		Same as C1-13, mounted in OSCILLATOR can.	H-f Osc. Trimmer, Band III		
C2-1	3D9400V-1	CAPACITOR: Variable; 5 section; each section 12.5 to 400 mmf, ±10%.	Loop tuning	Radio Condenser Company	L7094B
C2-2		Same as C2-1.	Antenna tuning		
C2-3		Same as C2-1.	1st r-f tuning		
C2-4		Same as C2-1.	2nd r-f tuning		
C2-5		Same as C2-1.	H-f osc. tuning		

C3-1	3DA50-15	CAPACITOR: Fixed; 0.05 mfd, ±10%; 400 volts dcw, paper.	V1 plate bypass	Micamold or Solar	A18015-503
C3-2		Same as C3-1.	V1 screen bypass		
C3-5		Same as C3-1.	V4 screen bypass		
C3-6		Same as C3-1.	V4 plate bypass		
C3-7		Same as C3-1.	V5 screen bypass		
C3-8		Same as C3-1.	V5 plate bypass		
C3-9		Same as C3-1.	V6 screen bypass		
C3-10		Same as C3-1.	V8 plate bypass		
C3-11		Same as C3-1.	V8 screen bypass		
C3-12		Same as C3-1.	V6 plate bypass		
C3-13		Same as C3-1.	V2 grid coupling		
C3-14		Same as C3-1.	V2 grid coupling		
C3-15		Same as C3-1.	V7 plate bypass		
C3-16		Same as C3-1.	V3 plate bypass		
C3-18		Same as C3-1.	V3 grid coupling, LF		
C3-19		Same as C3-1.	V3 grid coupling, LF		
C3-20		Same as C3-1.	V9 grid blocking		
C3-21		Same as C3-1.	V9 plate bypass		
C4-1	3DKA50-70	CAPACITOR: Fixed; paper; 0.05 mfd, ±10%; 200 volts dcw.	VI cathode bypass	Micamold type 342-6	A18181-503
C4-2		Same as C4-1.	V3 cathode bypass		
C4-3		Same as C4-1.	V4 cathode bypass		
C4-4		Same as C4-1.	V5 cathode bypass		
C4-5		Same as C4-1.	V6 cathode bypass		
C4-6		Same as C4-1.	V8 cathode bypass		
C4-7		Same as C4-1.	V10 cathode bypass		
C4-8		Same as C4-1.	V4 AVC filter		

TABLE OF REPLACEABLE PARTS (Continued)

MODEL: MN-26* RADIO COMPASS EQUIPMENT — PART I — MAJOR UNIT: TYPE MN-26* RADIO COMPASS

Reference Symbol	Army Stock No. Navy Type No. British Ref. No.	Name of Part and Description	Function	Mfr. and Designation	Drawing or Spec. No.
C4-9		Same as C4-1.	V5 AVC filter		
C4-10		Same as C4-1.	V6 AVC filter		
C4-11		Same as C4-1.	V3 cathode filter		
C5-1	3DA100-8	CAPACITOR: Fixed; paper; 0.1 mfd, ±10%, 200 volts dcw.	V12 grid bypass	Micamold type 345-5	A18181-104
C5-2			V12 plate resonator		
C6-1	3DKA20-78	CAPACITOR: Fixed; paper; 0.02 mfd, ±10%, 200 volts dcw.	AVC filter	Micamold type 342-3	A18181-203
C6-2		Same as C6-1.	V8 AVC bypass		
C7	3DA500-17	CAPACITOR: Fixed, oil-paper; o.5 mfd, ±10%; 400 volts dcw.	V12 grid coupling	Aerovox special	E11398
C8	3DB5-16	CAPACITOR: Fixed, oil-paper; 5 mfd, +100%, –0%; 50 volts dcw.	V11 cathode bypass	Aerovox special	E11402
C9-1	3DA500-19	CAPACITOR: Fixed, oil-paper; 2 sections; each section 0.5 mfd, +20%, –10%; 100 volts dcw.	LV filter bypass	Aerovox special	E11400
C9-2		Same as C9-1.	LV filter bypass		
C10-1	3DB6-8	CAPACITOR: Fixed, oil-filled; 2 section; each section 6.0 mfd, +100%, –10%; 400 volts dcw.	HV filter	Aerovox	A15066
C10-2		Same as C10-1.	HV filter		
C12-1	3DK9050-49.1	CAPACITOR: Fixed; ceramicon; 50 mmf, ±2.5 mmf; 500 volts dcw.	V10 r-f bypass	Erie type N750	A18182-7
C12-2		Same as C12-1.	V10 grid bypass		
C13	3D369	CAPACITOR: Fixed; ceramic; 100 mmf, ±10%, 500 volts dcw.	V10 r-f bypass	Erie type N680L	A18205-101
C14-1	3DA5-40	CAPACITOR: Fixed; mica; 5000 mmf, ±2%; 300 volts dcw.	V4 i-f trap resonator	Cornell-Dubilier type 1WL; Aerovox type 1467	C56310-502
C14-2		Same as C14-1.	V5 i-f trap resonator		

C15	3DA1-55	CAPACITOR: Fixed; mica; 1000 mmf, ±10%; 500 volts dcw.	Antenna coupling	Cornell-Dubilier type 5WL; Aerovox type 1468	C56315-102
C16	3DA10-98	CAPACITOR: Fixed; mica; 0.01 mf, ±10%; 300 volts dcw.	V11 grid coupling	Cornell-Dubilier type 1WL; Aerovox type 1467	C56312-103
C17	3D9025-29	CAPACITOR: Fixed; mica; 25 mmf, ±10%; 500 volts dcw.	V7 grid compensating	Cornell-Dubilier type 5WL; Aerovox type 1468	C56315-250
C19-1	3DK9250-57	CAPACITOR: Fixed; mica; 250 mmf, ±5%; 500 volts dcw.	V3 grid r-f coupling	Cornell-Dubilier type 5WL; Aerovox type 1468	C56314-251
C19-2		Same as C19-1.	V3 grid r-f coupling		
C20-2	3D9010-5	CAPACITOR: Fixed; ceramic; 10 mmf, ±10%; 500 volts dcw.	Oscillator trimmer compensating	Erie type N680L	A18205-100
C21-4	3D9100-49	CAPACITOR: Fixed; mica; 100 mmf, ±5%; 500 volts, dcw.	V10 AVC diode coupling	Cornell-Dubilier type 5WL; Aerovox type 1468	C56314-100
C21-5		Same as C21-4.	V9 grid coupling		
C25	3D9015-17	CAPACITOR: Fixed; mica; 15 mmf, ±10%; 500 volts, dcw.	V6 injector grid coupling	Cornell-Dubilier type 5WL; Aerovox type 1468	C56315-150
C34-1	3D9500-80	CAPACITOR: Fixed; mica; 500 mmf, ±2%; 500 volts, dcw.	V6 plate resonator	Cornell-Dubilier type 5WL; Aerovox type 1468	C56313-501
C34-2		Same as C34-1.	V8 grid resonator		
C34-3		Same as C34-1.	V8 plate resonator		
C34-4		Same as C34-1.	V10 diode resonator		
C34-5		Same as C34-1.	V9 grid resonator		
C35	3D9500-11	CAPACITOR: Fixed; mica; 500 mmf, ±10%; 500 volts, dcw.	V10 plate bypass	Cornell-Dubilier type 5WL; Aerovox type 1468	
C37-1	3DA100-14	CAPACITOR: Fixed; paper; 3-section, each section 0.1 mf, ±10%; 400 volts, dcw.	LV dynamotor, r-f filter	Aerovox special	E11347-1
C37-2		Same as C37-1.	HV dynamotor, r-f filter		
C37-3		Same as C37-1.	HV dynamotor, r-f filter		

TABLE OF REPLACEABLE PARTS (Continued)

MODEL: MN-26* RADIO COMPASS EQUIPMENT PART I MAJOR UNIT: TYPE MN-26* RADIO COMPASS

Reference Symbol	Army Stock No. Navy Type No. British Ref. No.	Name of Part and Description	Function	Mfr. and Designation	Drawing or Spec. No.
C38	3DK9100-49.1	CAPACITOR: Fixed; mica; 100 mmf, ±2%; 500 volts, dcw.	V1 plate resonator	Cornell-Dubilier type 5WL; Aerovox type 1468	C56313-101
C39-1	3DA100-124	CAPACITOR: Fixed; paper; 0.1 mf, ±10%; 400 volts, dcw.	V2 plate #1 bypass	Micamold or Solar	A18015-104
C39-2		Same as C39-1.	V2 plate #2 bypass		
C39-5		Same as C39-1.	V12 screen bypass		
J4	2Z7133.1	RECEPTACLE: 23-contact; located on front panel.	Receptacle for P4	Cannon type NK-C23-32S	A30094
J7	2Z7116.3	RECEPTACLE: 6-contact; located on front panel.	Receptacle for P7	Cannon type WK-6-32S	A30084
J10	2Z7228-26	RECEPTACLE: 1-contact; located on front panel.	Receptacle for P10	Jones #101	B7380-1
L1	3CK3010B/P1/C	INDUCTOR: 1 coil, sealed, 670 turns #39SSE.	Loop phaser	Bendix	AL71791-16
L2	2C3010B/T37	INDUCTOR: 425 mh, ±1%; 95-7/8 turns, #30/44 Litz, sealed.	I-f trap	Bendix	AE11635-1
L3		Same as L2.	I-f trap	Bendix	AE11634-1
L6	3CK4001-2	INDUCTOR: 1 coil; sealed, tapped.	BFO coil assembly	Bendix	AL71791-17
L7-1	2C3010B/L7	INDUCTOR: 45 turns #185SE.	LV r-f choke	Bendix	AB6859-1
L7-2		Same as L7-1.	LV r-f choke		
L8	2C3010B/L8	INDUCTOR: 40 ohms.	HV r-f choke	Bendix	AB6859-2
L9-1		INDUCTOR: 6 henries; 50 ma; 340 ohms. Part of T-15.	V11 filter choke		
L9-2		Same as L9-1.	HV filter choke		
L10		INDUCTOR: 410 turns #15/44 SS Litz. Part of T-13.	V6 plate	Bendix	AA26868-1
L11		Same as L10; part of T-13.	V8 plate	Bendix	AA26867-1
L12		Same as L10; except part of T-14.	V8 plate	Bendix	AA26868-1
L13		Same as L10; except part of T-14.	V10 audio diode	Bendix	AA26869-1

NE1	2Z5893-1	NEON TUBE: 1/25 watt, 60 volts a-c; unbased.	Overload discharge LOOP can	General Electric type T-2	QB15347
NE2		Same as NE1.	Overload discharge ANTENNA can		
P10	2Z7242-80	PLUG: 1 pin contact; ⅛" diameter, ½" long, for J10.	Non-directional antenna plug	Jones #101	B7380-2
R1	2C3010B/P3	POTENTIOMETER: 15,000 ohms; curve D; slotted (screwdriver) shaft; right-hand (when looking at shaft end) terminal removed.	Loop gain control	IRC type "C"	QB15353
R7	3Z6030-41	RESISTOR: Fixed; 300 ohm, ±10%, ½ watt; ceramic.	V1 cathode bias	Erie	A18151-301
R10-1	3Z6001-2	RESISTOR: Fixed; 10 ohms, ±5%; ½ watt; wire wound.	V4 r-f compensator Band II	IRC type BW-½	A16428-2
R10-2		Same as R10-1.	V5 r-f compensator Band II		
R12-2	3Z6700-61	RESISTOR: Fixed; 100,000 ohms, ±10%; ½ watt, ceramic.	V4 screen voltage dropping	Erie	A18151-104
R12-3		Same as R12-2.	V5 screen voltage dropping		
R12-4		Same as R12-2.	V10 grid		
R12-5		Same as R12-2.	V8 AVC filter		
R12-6		Same as R12-2.	V3 audio voltage supply		
R12-7		Same as R12-2.	V3 audio voltage supply		
R12-8		Same as R12-2.	AVC filter		
R12-9		Same as R12-2.	Sidetone filter		
R12-10		Same as R12-2.	V2 audio voltage filter		
R12-11		Same as R12-2.	V2 audio voltage filter		
R12-12		Same as R12-2.	V3 cathode bias		
R12-13		Same as R12-2.	V3 plate dropping		
R12-14		Same as R12-2.	V9 grid leak		
R12-15		Same as R12-2.	V9 plate voltage dropping		
R13-1	3Z6715-24	RESISTOR: Fixed; 150,000 ohms, ±10%; ½ watt, ceramic.	V6 screen voltage bleeder	Erie	A18151-154

TABLE OF REPLACEABLE PARTS (Continued)

MODEL: MN-26* RADIO COMPASS EQUIPMENT — PART I — MAJOR UNIT: TYPE MN-26* RADIO COMPASS

Reference Symbol	Army Stock No. Navy Type No. British Ref. No.	Name of Part and Description	Function	Mfr. and Designation	Drawing or Spec. No.
R13-2		Same as R13-1.	V12 screen voltage dropping		
R14-1	3Z6650-22	RESISTOR: Fixed; 50,000 ohms; ±10%, ½ watt; ceramic.	V2 grid leak	Erie	A18151-503
R14-2		Same as R14-1.	V2 grid leak		
R14-3		Same as R14-1.	V6 injector grid leak		
R14-4		Same as R14-1.	V7 grid leak		
R14-5		Same as R14-1.	V10 r-f filter		
R14-6		Same as R14-1.	V3 cathode bias		
R14-7		Same as R14-1.	V4 AVC filter		
R14-8		Same as R14-1.	V5 AVC filter		
R14-9		Same as R14-1.	V6 AVC filter		
R14-10		Same as R14-1.	V8 screen voltage dropping		
R14-11		Same as R14-1.	V7 plate voltage dropping		
R14-12		Same as R14-1.	V9 grid return		
R14-13		Same as R14-1.	V1 screen voltage dropping		
R15-1	3Z6200-40	RESISTOR: Fixed, 2,000 ohms, ±10%; ½ watt, ceramic.	V2 plate load	Erie	A18151-202
R15-2		Same as R15-1.	V2 plate load		
R18-1	3Z6801-36	RESISTOR: Fixed; 1.0 megohm, ±10%, ½ watt, ceramic.	Antenna static leak	Erie	A18151-105
R19-1	3Z6100-58	RESISTOR: Fixed, 1,000 ohms, ±10%; ½watt, ceramic.	V12 grid	Erie	A18151-102
R19-2		Same as R19-1.	V1 plate voltage dropping		
R20-2	3Z6500-83	RESISTOR: Fixed; 5,000 ohms, ±10%; ½ watt, ceramic.	V4 plate voltage dropping	Erie	A18151-502

R20-3		Same as R20-2.	V5 plate voltage dropping		
R20-4		Same as R20-2.	V6 plate voltage dropping		
R20-5		Same as R20-2.	V8 plate voltage dropping		
R21	3Z6720-15	RESISTOR: Fixed; 200,000 ohms, ±10%; ½ watt; ceramic.	V3 cathode bleeder	Erie	A18151-204
R22-1	3Z6750-31	RESISTOR: Fixed; 500,000 ohms, ±10%; ½ watt; ceramic.	V3 grid load	Erie	A18151-504
R22-2		Same as R22-1.	V3 grid load		
R22-3		Same as R22-1.	V12 grid		
R22-4		Same as R22-1.	V10 AVC diode load		
R22-5		Same as R22-1.	V11 grid		
R23	3Z6610-57	RESISTOR: Fixed; 10,000 ohms, ±10%; ½ watt, ceramic.	V3 cathode bias	Erie	A18151-103
R24-1	3ZK6060-45	RESISTOR: Fixed; 600 ohms, ±10%; ½ watt, ceramic.	V4 cathode bias	Erie	A18151-691
R24-2		Same as R24-1.	V5 cathode bias		
R24-3		Same as R24-1.	V6 cathode bias		
R24-4		Same as R24-1.	V8 cathode bias		
R24-5		Same as R24-1.	V12 cathode bias		
R27	3Z6010-36	RESISTOR: Fixed; 100 ohms, ±10%; ½ watt, ceramic.	V2 cathode bias	Erie	A18151-101
R28	3Z6725-21	RESISTOR: Fixed; 250,000 ohms, ±10%; ½ watt, ceramic.	V10 grid load	Erie	A18151-254
R29	3Z6050-40	RESISTOR: Fixed; 500 ohms, ±10%; ½ watt, ceramic.	V11 cathode bias	Erie	A18151-501
R31	3Z6300-32	RESISTOR: Fixed; 3,000 ohms, ±10%; ½ watt, ceramic.	V10 cathode bias	Erie	A18151-302
R32	3Z6730-10	RESISTOR: Fixed; 300,000 ohms, ±10%; ½ watt, ceramic.	V12 grid isolating	Erie	A18151-304
R35-1	3Z6011G7	RESISTOR: Fixed; 2 section; 117 ohms total; 50 ohms section A; 67 ohms section B; wire wound; metal case.	Azimuth dial light dropping	IRC type MW2	A14739
		Alternate: Same as above except it has a phenolic case.			A110729-1
R36	3Z6019E5-1	RESISTOR: Fixed; 2 section; 195 ohms total; 120 ohms section A; 75 ohms section B; wire wound; metal case.	Antenna relay voltage dropping	IRC type MW2	A30031
		Alternate: Same as above except for phenolic case.			A110729-3

TABLE OF REPLACEABLE PARTS (Continued)

MODEL: MN-26* RADIO COMPASS EQUIPMENT — PART I — MAJOR UNIT: TYPE MN-26* RADIO COMPASS

Reference Symbol	*Army Stock No. Navy Type No. British Ref. No.*	*Name of Part and Description*	*Function*	*Mfr. and Designation*	*Drawing or Spec. No.*
R37-1	3Z6007E5-2	RESISTOR: Fixed; 2 section; 75.6 ohms total; 12.6 ohms section A; 63 ohms section B; wire wound, metal case.	Filament current compensating	IRC type MW2	A15273
R37-2		Alternate: Same as above, but has phenolic case. Same as R37-1.	Sidetone relay dropping		A110729-2
R38	3Z6625-37	RESISTOR: Fixed; 25,000 ohms, ±10%; ½ watt; ceramic.	V10 plate voltage dropping	Erie	A18151-253
R39	3Z6625-8	RESISTOR: Fixed; 25,000 ohms, ±10%; 1 watt; ceramic.	V6 screen voltage dropping	Erie	A18150-253
RE1	2Z7717.8	RELAY: Antenna switching; DPDT; beryllium copper or nickel-alloy contact springs with win-silver contacts; 8 to 16 volt operation; 100% humidity from –40° to +65° C.; grade XXX phenolic insulation.	Non-directional antenna switching	Kurman Electric type 15P32	QB7856
RE2		Same as RE1.	Sidetone control		
S1-1	3Z9827.10	SWITCH: Rotary; one single-pole three-throw non-shorting switch; one single-pole, three-throw shorting switch.	Loop band selector, primary	Oak type H	QB9589-2
S1-2		Same as S1-1.	Antenna band selector primary 1		
S1-3		Same as S1-1.	1st r-f band selector primary, secondary		
S1-4		Same as S1-1.	2nd r-f band selector primary, secondary		
S2	3C3010B/S18	SWITCH: Rotary; single-pole, single throw; shorting type switch.	LOOP band selector secondary	Oak type H	QB9589-1
S3	2C3010B/S14	SWITCH: Rotary; two single-pole three-throw shorting type switch.	ANTENNA band selector primary secondary	Oak type H	QB9589-4
S4	2C3010B/S16	SWITCH: Rotary; one single-pole non-shorting; one single-pole shorting type; and one single-pole three-throw grounding switch.	H-f oscillator band switch	Oak type H	QB9589-3
S5	2C3010B/S15	SWITCH: Rotary; one single-pole three-throw non-shorting type switch and one single-pole three-throw shorting type switch.	Motor positioning	Oak type H	QB9589-5

S6	3ZK9875-2	SWITCH: Cam operated; 5 spring contacts; three positions, opens two contacts and connects three contacts in normal position; opens all contacts in midway position; and connects two contacts and opens three contacts in the upper position; beryllium-copper, nickel silver, or phos. bronze springs with fine silver contacts.	Motor control by shifting motor circuits	Bendix	E10355
T13	2Z9641.15	TRANSFORMER: I-f contains L10, L11, C6-2, C3-12, C34-1, C34-2, R12-5.	1st i-f transformer	Bendix	AL71798-1
T14	2Z9641.16	TRANSFORMER: I-f; contains C3-10, C12-1, C12-2, C13, C21-4, C34-3, C34-4, L12, L13, R12-4, R12-8, R14-5, R22-4.	2nd i-f transformer	Bendix	AL71908-1
T15	2Z9626.6	TRANSFORMER: A-f; contains T15, L9-1.	Audio output	Bendix	A14987
T16	2Z9626.7	TRANSFORMER: A-f; contains T16, L9-2, C5-2.	Compass output	Bendix	A15064
V1	2J6K7	VACUUM TUBE: Type JAN-6K7 triple-grid super control amplifier.	Loop amplifier	6K7	
V2	2J6N7	VACUUM TUBE: Type JAN-6N7 class B, twin amplifier.	Audio oscillator	6N7	
V3	2J6N7	VACUUM TUBE: Type JAN-6N7 class B, twin amplifier.	Modulator	6N7	
V4	2J6K7	VACUUM TUBE: Same as V1.	1st r-f amplifier	6K7	
V5	2J6K7	VACUUM TUBE: Same as V1.	2nd r-f amplifier	6K7	
V6	2J6L7	VACUUM TUBE: Type JAN-6L7 pentagrid mixer amplifier.	1st detector	6L7	
V7	2J6J5	VACUUM TUBE: Type JAN-6J5 detector amplifier triode.	H-f oscillator	6J5	
V8	2J6K7	VACUUM TUBE: Same as V1.	I-f amplifier	6K7	
V9	2J6J5	VACUUM TUBE: Same as V7.	C-w oscillator	6J5	
V10	2J6B8	VACUUM TUBE: Type JAN-6B8 duplex-diode pentode.	2nd detector, 1st audio and AVC	6B8	
V11	2J6F6	VACUUM TUBE: Type JAN-6F6 power amplifier pentode.	Audio output	6F6	
V12	2J6K7	VACUUM TUBE: Same as V1.	Compass output and 48 cycle AVC	6K7	
J9	2Z7116.3	RECEPTACLE: Wall-mounting type; 6-contact; WK-6-32S.	Receptacle for plug P9	Cannon WK-6-32S	A30094
LM-2	2Z5932	LAMP: 3-volt, 0.19 ampere.	Dial illumination	Pioneer Inst.	A18881-1
S11	3ZK9858-8.26	SWITCH: Toggle; SPST; 13/64″ shank.	LIGHT-OFF control of LM-2	H & H	B418-1
S12	3ZK9875-4	SWITCH: Cam operated.	Loop off-zero warning light control	Bendix	AA14661-1
S13	3ZK9858-8.26	SWITCH: Toggle; SPST; 13/64″ shank.	LOOP-ANT. control	H & H	B418-1

TABLE OF REPLACEABLE PARTS (Continued)

MODEL: MN-26* RADIO COMPASS EQUIPMENT PART I-A MAJOR UNIT: TYPE MN-26A, C, or CA RADIO COMPASS

Reference Symbol	Army Stock No. Navy Type No. British Ref. No.	Name of Part and Description	Function	Mfr. and Designation	Drawing or Spec. No.
C11-2	3D9035-6	CAPACITOR: Fixed; ceramic-dielectric; 35 mmf, ±10%; 500 volts dcw.	V5 grid parallel padder	Erie type N680K	A18207-350
C11-3		Same as C11-2.	V6 grid parallel padder		A18205-100
C20-1	3D9010-5	CAPACITOR: Fixed; ceramic-dielectric; 10 mmf, ±10%; 500 volts dcw.	V4 antenna coupling	Erie type N680L	
C20-2		Same as C20-1.	Trimmer compensating		
C21-1	3D9100-49	CAPACITOR: Fixed; mica-dielectric; 100 mmf, ±5%; 500 volts dcw; low-loss case.	Antenna compensating	Cornell-Dubilier type 5WL, Aerovox type 1468	C56314-251
C21-2		Same as C21-1.	V4 plate resonator, band 3		
C21-3		Same as C21-1.	V5 plate resonator, band 3		
C22-1	3D9300-1	CAPACITOR: Fixed; mica-dielectric; 300 mmf, ±5%; 500 volts dcw; low-loss case.	V4 plate resonator, band 1	Cornell-Dubilier type 5WL, Aerovox type 1468	C56314-301
C22-2		Same as C22-1.	V5 plate resonator, band 1		
C23-1	3D9075-1	CAPACITOR: Fixed; mica-dielectric; 75 mmf, ±5%; 500 volts dcw; low-loss case.	V4 plate resonator, band 2	Cornell-Dubilier type 5WL, Aerovox type 1468	C56314-750
C23-2		Same as C23-1.	V5 plate resonator, band 2		
C24-1	3D9005-12	CAPACITOR: Fixed, ceramic-dielectric; 5 mmf, ±10%; 500 volts dcw.	T9-1 coupling	Erie type P120K	A29857-050
C24-2		Same as C24-1.	T9-2 coupling		
C29	3D9025-39	CAPACITOR: Fixed; 25 mmf, ±10%; 500 volts dcw.	V4 grid parallel padder	Erie type N680K	A18207-250
C30	3D9625	CAPACITOR: Fixed; two capacitors soldered together to give 625 mmf, ±2%; mica-dielectric; 300 volts dcw; XM-262 bakelite case.	V7 series padder, band I	Aerovox special	E12140-2

C31	3DA1.286	CAPACITOR: Fixed: mica-dielectric; two capacitors soldered together to give a total of 1286 mmf; ±2%; 500 volts dcw; XM-262 bakelite case.	V7 series padder, band II	Aerovox special	E12140-3
C32	3DA2.514	CAPACITOR: Fixed, mica-dielectric; 2514 mmf, ±2%; 300 volts dcw.	V7 series padder, band III	Aerovox special	E12140-4
C40-1	3D9030-15	CAPACITOR: Fixed; ceramic-dielectric; 30 mmf, ±10%; 500 volts dcw.	V7 grid parallel padder	Erie type N680K	A18207-300
C40-2		Same as C40-1.	V1 grid parallel padder		
C54	3D9005-12	CAPACITOR: Fixed; ceramic-dielectric; 5 mmf, ±0.5%; 500 volts dcw.	V9 grid coupling	Erie type P120K	A18182-2
DYN	3H1514-3	DYNAMOTOR: Notice: Submit nameplate data when ordering replacement parts of dynamotors or motors.	Plate voltage supply	Bendix Eico Pioneer	See Table XLI, section VL, paragraph
MO-1		MOTOR: See above notice. For MN-26A. For MN-26C, CA.	Band switch motor	Bendix Eico Pioneer	 E11500-2 E11500-1
R9-1	3Z5993-3	RESISTOR: Fixed; 3 ohms; ½ watt; wire wound.	V1 r-f compensator, band 3	IRC type BW-½	A16428-3
R9-2		Same as R9-1.	V5 r-f compensator, band 3		
R9-3		Same as R9-2.	V6 r-f compensator, band 3		
R11-1	3Z6002-2	RESISTOR: Fixed; 20 ohms; ±5%; ½ watt; wire wound.	V5, r-f compensator	IRC type BW-½	A16428-4
R11-2		Same as R11-1.	V6 r-f compensator, band 1		
T-1	2C3010B/T20-1	TRANSFORMER: R-f; two coils, sealed.	LOOP can, band 1	Bendix	AL71791-1
T-2	2C3010B/T20-2	TRANSFORMER: R-f; two coils, sealed.	LOOP can, band 2	Bendix	AL71791-2
T-3	2C3010B/T20-3	TRANSFORMER: R-f; two coils, sealed.	LOOP can, band 3	Bendix	AL71791-3
T-4	3C4000	TRANSFORMER: R-f; three coils, sealed.	ANTENNA can, band 1	Bendix	AL71791-13
T-5	3C4001	TRANSFORMER: R-f; three coils, sealed.	ANTENNA can, band 2	Bendix	AL71791-14
T-6	3C4001-1	TRANSFORMER: R-f; three coils, sealed.	ANTENNA can, band 3	Bendix	AL71791-15
T7-1	3C4010	TRANSFORMER: R-f; three coils, sealed.	RADIO FREQ.-1 can, band 1	Bendix	AL71791-7
T7-2		Same as T7-1.	RADIO FREQ.-2 can, band 1		

TABLE OF REPLACEABLE PARTS (Continued)

MODEL: MN-26* RADIO COMPASS EQUIPMENT   PART I-A   MAJOR UNIT: TYPE MN-26A, C, or CA RADIO COMPASS

Reference Symbol	*Army Stock No. Navy Type No. British Ref. No.*	*Name of Part and Description*	*Function*	*Mfr. and Designation*	*Drawing or Spec. No.*
T8-1	3C4011-1	TRANSFORMER: R-f; two coils, sealed.	RADIO FREQ.-1 can, band 2	Bendix	AL71791-8
T8-2		Same as T8-1.	RADIO FREQ.-2 can, band 2		
T9-1	3C4011-2	TRANSFORMER: R-f; two coils, sealed.	RADIO FREQ.-1 can, band 3	Bendix	AL71791-9
T9-2		Same as T9-1.	RADIO FREQ.-2 can band 3		
T10	2C3010B/T27	TRANSFORMER: r-f; two coils, sealed.	Oscillator can, band 1	Bendix	AL71791-4
T11	2C3010B/T28	TRANSFORMER: r-f; two coils, sealed.	Oscillator can, band 2	Bendix	AL71791-5
T12	2C3010B/T29	TRANSFORMER: r-f; two coils, sealed.	Oscillator can, band 3	Bendix	AL71791-6
Z1	3CK1084C-26	OSCILLATOR CAN ASSEMBLY.	Oscillator components	Bendix	AL72326-1
Z2-1	3CK1084C-22	R-F CAN ASSEMBLY.	First r-f components	Bendix	AF11113-1
Z2-2		Same as Z2-1.	Second r-f components	Bendix	AF11113-1
Z3	3CK1084C-24	ANTENNA CAN ASSEMBLY.	Antenna circuit components	Bendix	AL72325-1
Z4	3CK1084C-25	LOOP CAN ASSEMBLY.	Loop circuit components	Bendix	AL72324-2

MODEL: MN-26* RADIO COMPASS EQUIPMENT PART I-B MAJOR UNIT: TYPE MN-26M RADIO COMPASS

Reference Symbol	Army Stock No. Navy Type No. British Ref. No.	Name of Part and Description	Function	Mfr. and Designation	Drawing or Spec. No.
C11-4	3D9035-6	CAPACITOR: Fixed; ceramic-dielectric; 35 mmf ±10%; 500 volts dcw.	V4 grid parallel padder	Erie type N680K	A18207-350
C18-1		CAPACITOR: Fixed; ceramic-dielectric; 10 mmf ±10%; 500 volts dcw.	T9-1 coupling	Erie type P120K	A29857-100
C18-2		Same as C18-1.	T9-2 coupling		
C20-2	3D9010-5	CAPACITOR: Fixed; ceramic-dielectric; 10 mmf ±10%; 500 volts dcw.	Trimmer compensating	Erie type N690L	A19205-100
C20-4		Same as C20-2.	Trimmer compensating		
C26-3		CAPACITOR: Fixed; ceramic-dielectric; 15 mmf ±10%; 500 volts dcw.	V4 antenna coupling	Erie	A18207-150
C28-1		CAPACITOR: Fixed; mica dielectric; 175 mmf ±5%; 500 volts dcw.	V4 plate resonator, band 1	Cornell-Dubilier type 5WL Aerovox type 1468	C56314-1750
C28-3		Same as C28-1.	V5 plate resonator, band 1		
C30	3D9625	CAPACITOR: Fixed; two capacitors soldered together to give total of 625 mmf ±2%; mica-dielectric; 300 volts dcw XM-262 bakelite case.	V7 series padder, band 1	Aerovox special	E12140-2
C31	3DA1.286	CAPACITOR: Fixed; mica-dielectric; two capacitors soldered together to give total of 1286 mmf ±2%; 500 volts dcw; XM262 bakelite case.	V7 series padder, band 2	Aerovox special	E13140-3
C33-3		CAPACITOR: Fixed; ceramic-dielectric; 40 mmf ±10%; 500 volts dcw.	V7 grid parallel padder	Erie	A18207-400
C42	3D9010-37	CAPACITOR: Fixed; mica-dielectric; two capacitors soldered together to give total of 6900 mmf ±2%; 300 volts dcw; XM262 bakelite case.	V7 series padder, band 3	Aerovox special	E12140-11
C43-1		CAPACITOR: Fixed; mica-dielectric; 50 mmf ±2%; 500 volts dcw.	Antenna compensating	Cornell-Dubilier type 5WL Aerovox type 1468	C56314-500
C43-2		Same as C43-1.	V4 plate resonator, band 2		

TABLE OF REPLACEABLE PARTS (Continued)

MODEL: MN-26* RADIO COMPASS EQUIPMENT — PART I-B — MAJOR UNIT: TYPE MN-26M RADIO COMPASS

Reference Symbol	*Army Stock No. Navy Type No. British Ref. No.*	*Name of Part and Description*	*Function*	*Mfr. and Designation*	*Drawing or Spec. No.*
C43-3		Same as C43-1.	V5 plate resonator, band 2		
C53-1		CAPACITOR: Fixed; ceramic-dielectric; 45 mmf ±2%; 500 volts dcw.	V5 grid parallel padder	Erie	A25715-9
C53-2		Same as C53-1.	V6 grid parallel padder		
C54	3D9005-12	CAPACITOR: Fixed; ceramic-dielectric; 5 mmf ±0.5 mmf; 500 volts dcw.	V9 grid coupling	Erie type P120K	A18182-2
C57		CAPACITOR: Fixed; ceramic-dielectric; 30 mmf ±10%; 500 volts dcw.	V1 grid parallel padder	Erie type N680K	A18207-300
C58		CAPACITOR: Fixed; ceramic-dielectric; 45 mmf ±10%; 500 volts dcw.	V1 grid parallel padder	Erie	A18207-450
DYN	3H1528	DYNAMOTOR: Submit nameplate data when ordering replacement parts of motors or dynamotors.	Plate voltage supply	Bendix Eicor Pioneer	C56728-7 C56728-2 C56728-1
MO-1		MOTOR: See above description of dynamotor.	Band switch motor	Bendix, Eicor Pioneer	E11500-1
R2-1		RESISTOR: Fixed; 25 ohms; ½ watt; wire wound.	V5 r-f compensator, band 1	IRC type BW-½	A16428-6
R2-2		Same as R2-1.	V6 r-f compensator, band 1		
T1		TRANSFORMER: r-f; two coils, sealed.	LOOP can, band 1	Bendix	AL72150-27
T2		TRANSFORMER: r-f; two coils, sealed.	LOOP can, band 2	Bendix	AL72150-28
T4		TRANSFORMER: r-f; three coils, sealed.	ANTENNA can, band 1	Bendix	AL72150-18
T5		TRANSFORMER: r-f; three coils, sealed.	ANTENNA can, band 2	Bendix	AL72150-19
T6		TRANSFORMER: r-f; three coils, sealed.	ANTENNA can, band 3	Bendix	AL72150-20
T7-1		TRANSFORMER: r-f; two coils, sealed.	RADIO FREQ.-1 can, band 1	Bendix	AL72150-6
T7-2		Same as T7-1.	RADIO FREQ.-2 can band 1		

T8-1		TRANSFORMER: r-f; two coils, sealed.	RADIO FREQ.-1 can, band 2	Bendix	AL72150-22
T8-2		Same as T8-1.	RADIO FREQ.-2 can band 2		
T9-1		TRANSFORMER: r-f; two coils, sealed.	RADIO FREQ.-1 can, band 3	Bendix	AL72150-23
T9-2		Same as R9-1.	RADIO FREQ.-2 can band 3		
T10		TRANSFORMER: r-f; two coils, sealed.	OSCILLATOR can, band 1	Bendix	AL72150-24
T11		TRANSFORMER: r-f; two coils, sealed.	OSCILLATOR can, band 2	Bendix	AL72150-25
T12		TRANSFORMER: r-f; two coils, sealed.	OSCILLATOR can, band 3	Bendix	AL72150-26
Z1		OSCILLATOR CAN ASSEMBLY.	Oscillator components	Bendix	AL72218-1
Z2-1		R-F CAN ASSEMBLY.	First r-f components	Bendix	AF11113-3
Z2-2		Same as Z2-1.	Second r-f components	Bendix	AF11113-3
Z3		ANTENNA CAN ASSEMBLY.	Antenna circuit components	Bendix	AL72217-1
Z4		LOOP CAN ASSEMBLY.	Loop circuit components	Bendix	AL72216-1

TABLE OF REPLACEABLE PARTS (Continued)

MODEL: MN-26* RADIO COMPASS EQUIPMENT — PART I-C — MAJOR UNIT: TYPE MN-26X or W RADIO COMPASS

Reference Symbol	Army Stock No. Navy Type No. British Ref. No.	Name of Part and Description	Function	Mfr. and Designation	Drawing or Spec. No.
C3-3		CAPACITOR: Fixed; 0.5 mf ±10%; 400 volts dcw; paper.	V1 avc filter	Micamold or Solar	A18015-503
C11-4	3D9035-6	CAPACITOR: Fixed; 35 mmf ±10%; 500 volts dcw; ceramic.	V4 grid parallel padder	Erie type N680K	A18207-350
C20-2	3D9010-5	CAPACITOR: Fixed; 10 mmf ±10%; 500 volts dcw; ceramic.	Trimmer compensating	Erie type N680L	A18205-100
C21-1	3D9100-49	CAPACITOR: Fixed; 100 mmf ±5%; 500 volts dcw; mica.	Antenna compensating	Cornell-Dubilier type 5WL, Aerovox type 1468	C56314-251
C24-1	3D9005-12	CAPACITOR: Fixed; 5 mmf ±10%; 500 volts dcw; ceramic.	T9-1 coupling	Erie type P120K	A29857-050
C24-2		Same as C24-1.	T9-2 coupling		
C24-3		Same as C24-1. Replaced in later models by C54.	V9 grid coupling		
C26-3		CAPACITOR: Fixed; 15 mmf ±10%; 500 volts dcw; ceramic.	V4 antenna coupling	Erie	A18207-150
C28-1		CAPACITOR: Fixed; 175 mmf ±5%; 500 volts dcw; mica.	V4 plate resonator, band 1	Cornell-Dubilier type 5WL, Aerovox type 1468	C56312-1750
C28-3		Same as C28-1.	V5 plate resonator, band 1		
C33-3		CAPACITOR: Fixed; 40 mmf ±10%; 500 volts dcw; ceramic.	V7 grid parallel padder	Erie	A18207-400
C41-1		CAPACITOR: Fixed; 40 mmf ±5%; 500 volts dcw; ceramic.	V4 plate resonator, band 3	Cornell-Dubilier type 5WL, Aerovox type 1468	C56314-450
C41-2		Same as C41-1.	V5 plate resonator, band 3		
C43-1		CAPACITOR: Fixed; 50 mmf ±2%; 500 volts dcw; mica. In later models of Type MN-26W, C21-1 is used in place of C43-1.	Antenna compensating	Cornell-Dubilier type 5WL, Aerovox type 1468	C56314-500
C43-2		Same as C43-1.	V4 plate resonator, band 2		

C43-3		Same as C43-1.	V5 plate resonator band 2		
C48		CAPACITOR: Fixed; 815 mmf ±2%; 300 volts dcw; mica.	V7 series padder, band 1		E12140-8
C49		CAPACITOR: Fixed; 1625 mmf ±2%; 300 volts dcw; mica.	V7 series padder, band 2		E12140-9
C50		CAPACITOR: Fixed; 2820 mmf ±2%; 300 volts dcw; mica.	V7 series padder, band 3		E12140-10
C53-1		CAPACITOR: Fixed; 45 mmf ±2%; 500 volts dcw; ceramic.	V5 grid parallel padder		A25715-9
C53-2		Same as C53-1.	V6 grid parallel padder		
C57	3D9030-15	CAPACITOR: Fixed; 30 mmf ±10%; 500 volts dcw; ceramic.	V1 grid parallel padder	Erie type N680K	A18207-300
DYN	3H1528	DYNAMOTOR: Submit nameplate data when ordering replacement parts of motors or dynamotors.	Plate voltage supply	Bendix, Eicor, Pioneer	C56728-1
M0-1		MOTOR: See dynamotor description.	Band switch drive	Bendix, Eicor, Pioneer	E11400-1 or E11400-2
R2-1		RESISTOR: Fixed; 25 ohms; ½ watt; wire wound.	V5 r-f compensator, band 1	Erie	A16428-6
R2-2		Same as R2-1.	V6 r-f compensator, band 1		
R9-1	3Z5993-3	RESISTOR: Fixed; 3 ohms; ½ watt, wire wound.	V1 r-f compensator, band 3	IRC	A16428-3
R9-2		Same as R9-1.	V5 r-f compensator band 3		
R9-3		Same as R9-1.	V6 r-f compensator band 3		
R12-1		RESISTOR: Fixed; 100,000 ohms; ±10%; ½ watt; ceramic.	Loop avc bypass	Erie	A18151-104
T1		TRANSFORMER: r-f, two coils, sealed.	LOOP can, band 1	Bendix	AL72150-31
T2		TRANSFORMER: r-f, two coils, sealed.	LOOP can, band 2	Bendix	AL72150-32
T3		TRANSFORMER: r-f, two coils, sealed.	LOOP can, band 3	Bendix	AL72150-33
T4		TRANSFORMER: r-f, three coils, sealed.	ANTENNA can, band 1	Bendix	AL72150-18
T5		TRANSFORMER: r-f, three coils, sealed.	ANTENNA can, band 2	Bendix	AL72150-19

TABLE OF REPLACEABLE PARTS (Continued)

MODEL: MN-26* RADIO COMPASS EQUIPMENT   PART I-C   MAJOR UNIT: TYPE MN-26X or W RADIO COMPASS

Reference Symbol	*Army Stock No. Navy Type No. British Ref. No.*	*Name of Part and Description*	*Function*	*Mfr. and Designation*	*Drawing or Spec. No.*
T6		TRANSFORMER: r-f, three coils, sealed.	ANTENNA can, band 3	Bendix	AL72150-20
T7-1	3C4010	TRANSFORMER: r-f, two coils, sealed.	RADIO FREQ.-1 can, band 1	Bendix	AL72150-6
T7-2		Same as T7-1.	RADIO FREQ.-2 can band 1		
T8-1		TRANSFORMER: r-f, two coils, sealed.	RADIO FREQ.-1 can, band 2	Bendix	AL72150-22
T8-2		Same as T8-1.	RADIO FREQ.-2 can band 2		
T9-1		TRANSFORMER: r-f, two coils, sealed.	RADIO FREQ.-1 can, band 3	Bendix	AL72150-23
T9-2		Same as T9-1.	RADIO FREQ.-2 can band 3		
T10		TRANSFORMER: r-f, two coils, sealed.	OSCILLATOR can, band 1	Bendix	AL72150-24
T11		TRANSFORMER: r-f, two coils, sealed.	OSCILLATOR can, band 2	Bendix	AL72150-25
T12		TRANSFORMER: r-f, two coils, sealed.	OSCILLATOR can, band 3	Bendix	AL72150-26
Z1		OSCILLATOR CAN ASSEMBLY.	Oscillator components	Bendix	AL72229-1
Z2-1		R-F CAN ASSEMBLY.	First r-f components	Bendix	AF11113-5
Z2-2		Same as Z2-1.	Second r-f components	Bendix	AF11113-5
Z3		ANTENNA CAN ASSEMBLY.	Antenna circuit components	Bendix	AL72228-1
Z4		LOOP CAN ASSEMBLY.	Loop circuit components	Bendix	AL72227-2

MODEL: MN-26* RADIO COMPASS EQUIPMENT PART I-D MAJOR UNIT: TYPE MN-26Y RADIO COMPASS

Reference Symbol	Army Stock No. Navy Type No. British Ref. No.	Name of Part and Description	Function	Mfr. and Designation	Drawing or Spec. No.
C11-1	3D9035-6	CAPACITOR: Fixed; 35 mmf ±10%; 500 volts dcw; ceramic.	V1 grid parallel padder	Erie type N680K	A18207-350
C11-2		CAPACITOR: Fixed. Same as C11-1.	V5 grid parallel padder		
C11-3		CAPACITOR: Same as C11-1.	V6 grid parallel padder		
C18-1		CAPACITOR: Fixed; 10 mmf ±10%; 500 volts dcw; ceramic.	T9-1 coupling	Erie type P120K	A29857-100
C18-2		Same as C18-1.	T9-2 coupling		
C18-3		Same as C18-1.	Trimmer compensating		
C18-4		Same as C18-1.	Trimmer compensating		
C20-2		Same as C20-1.	Trimmer compensating		
C20-3		Same as C20-1.	Trimmer compensating		
C21-1	3D9100-49	CAPACITOR: Fixed; mica-dielectric; 100 mmf ±5%; 500 volts dcw; low-loss case.	Antenna compensating	Cornell-Dubilier type 5WL; Aerovox type 1468	C56314-251
C22-1	3D9300-1	CAPACITOR: Fixed; 300 mmf ±20%; 500 volts dcw; mica.	V4 plate resonator, band 1	Cornell-Dubilier type 5WL; Aerovox type 1468	C56314-301
C22-2		Same as C22-1.	V5 plate resonator, band 1		
C23-1	3D9075-1	CAPACITOR: Fixed; 75 mmf ±5%; 500 volts dcw; mica.	V4 plate resonator, band 2	Cornell-Dubilier type 5WL; Aerovox type 1468	C56314-750
C23-2		Same as C23-1.	V5 plate resonator, band 2		
C24-4	3D9005-12	CAPACITOR: Fixed; 5 mmf ±10%; 500 volts dcw; ceramic.	V9 grid coupling	Erie type P120K	A29857-050
C26-3		CAPACITOR: Fixed; 15 mmf ±10%; 500 volts dcw; ceramic.	V4 antenna coupling	Erie	A18207-150
C29	3D9025-39	CAPACITOR: 25 mmf ±10%; 500 volts dcw; ceramic.	V4 grid parallel padder	Erie	A18207-250

TABLE OF REPLACEABLE PARTS (Continued)

MODEL: MN-26* RADIO COMPASS EQUIPMENT　　PART I-D　　MAJOR UNIT: TYPE MN-26Y RADIO COMPASS

Reference Symbol	Army Stock No. Navy Type No. British Ref. No.	Name of Part and Description	Function	Mfr. and Designation	Drawing or Spec. No.
C30	3D9625	CAPACITOR: Fixed; 625 mmf ±2%; 300 volts dcw; mica.	V7 series padder, band 1		E12140-2
C31	3DA1.286	CAPACITOR: Fixed; 1286 mmf ±2%; 300 volts dcw; mica.	V7 series padder, band 2		E12140-3
C40-1	3D9030-15	CAPACITOR: Fixed; 30 mmf ±10%; 500 volts dcw; ceramic.	V7 grid parallel padder	Erie	A18207-300
C42	3D9010-37	CAPACITOR: Fixed; 6900 mmf ±2%; 300 volts dcw; mica.	V7 series padder, band 3		E12140-11
C54	3D9005-12	CAPACITOR: Fixed; 5 mmf ±0.5 mmf; 500 volts dcw; ceramicon.	V9 grid coupling	Erie	A18182-2
C55		CAPACITOR: Fixed; 15 mmf ±10%; 500 volts dcw; ceramic.	Trimmer compensating	Erie	A18207-150
DYN	3H1528	DYNAMOTOR: Submit nameplate data when ordering replacement parts of motors or dynamotors.	Plate voltage supply	Bendix, Eicor, Pioneer	C56728-2
MO-1		MOTOR: See dynamotor description above.	Band switch drive	Bendix, Eicor, Pioneer	E11500-1
R11-1	3Z6002-2	RESISTOR: Fixed; 20 ohms; ½ watt; wire wound.	V5 r-f compensator, band 1	IRC	A16428-4
R11-2		Same as R11-1.	V6 r-f compensator, band 1		
T1	3CK4001-3	TRANSFORMER: r-f, two coils, sealed.	LOOP can, band 1	Bendix	AL72150-34
T2	3CK4001-4	TRANSFORMER: r-f, two coils, sealed.	LOOP can, band 2	Bendix	AL72150-35
T4	3C4000	TRANSFORMER: r-f, three coils, sealed.	ANTENNA can, band 1	Bendix	AL71791-13
T5	3C4001	TRANSFORMER: r-f, three coils, sealed.	ANTENNA can, band 2	Bendix	AL71791-14
T6	3CK4001-5	TRANSFORMER: r-f, three coils, sealed.	ANTENNA can, band 3	Bendix	AL72150-9
T7-1	3C4010	TRANSFORMER: r-f, two coils, sealed.	RADIO FREQ.-1 can, band 1	Bendix	AL71791-7
T7-2		Same as T7-1.	RADIO FREQ.-2 can, band 1	Bendix	AL71791-7

T8-1	3C4011-1	TRANSFORMER: r-f, two coils, sealed.	RADIO FREQ.-1 can, band 2	Bendix	AL71791-8
T8-2		Same as T8-2.	RADIO FREQ.-2 can, band 2	Bendix	AL71791-8
T9-1	3CK4011-3	TRANSFORMER: r-f, two coils, sealed.	RADIO FREQ.-1 can, band 3	Bendix	AL72150-10
T9-2		Same as T9-1.	RADIO FREQ.-2 can, band 3	Bendix	
T10	2C3010B/T27	TRANSFORMER: r-f, two coils, sealed.	OSCILLATOR can, band 1	Bendix	AL71791-4
T11	2C3010B/T28	TRANSFORMER: r-f, two coils, sealed.	OSCILLATOR can, band 2	Bendix	AL71791-5
T12	3CK4050	TRANSFORMER: r-f, two coils, sealed.	OSCILLATOR can, band 3	Bendix	AL72150-11
Z1		OSCILLATOR CAN ASSEMBLY.	Oscillator components	Bendix	AL72362-2
Z2-1		R-F CAN ASSEMBLY.	First r-f components	Bendix	AF11114-4
Z2-2		Same as Z2-1.	Second r-f components	Bendix	AF11114-4
Z3		ANTENNA CAN ASSEMBLY.	Antenna circuit components	Bendix	AL72325-2
Z4		LOOP CAN ASSEMBLY.	Loop circuit components	Bendix	AL72216-2

TABLE OF REPLACEABLE PARTS (Continued)

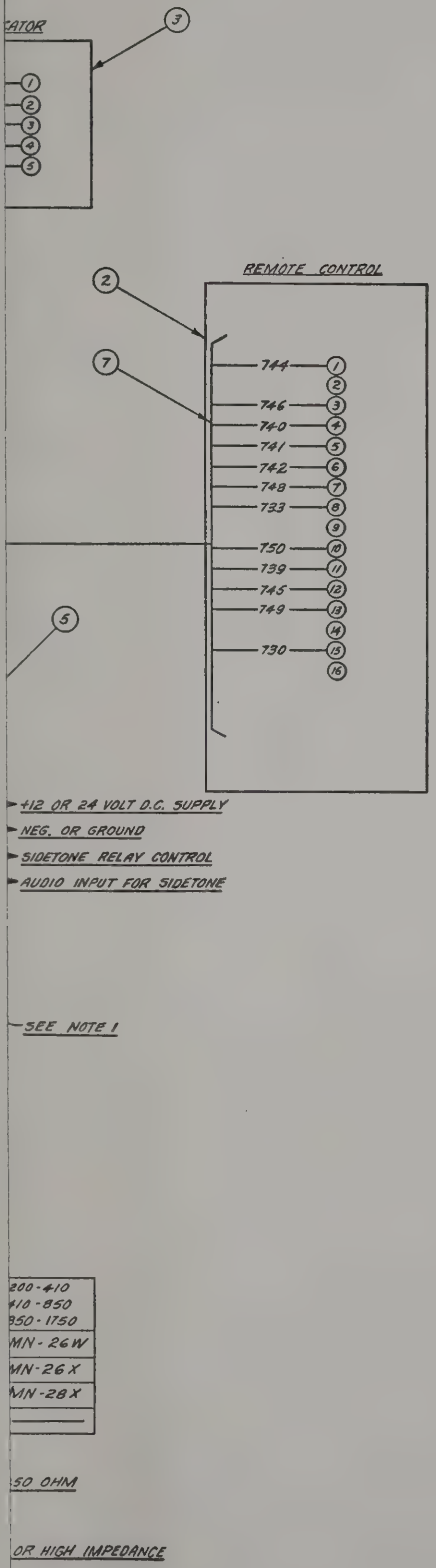
MODEL: MN-26* RADIO COMPASS EQUIPMENT PART II MAJOR UNIT: TYPE MN-28 REMOTE CONTROL

Reference Symbol	Army Stock No. Navy Type No. British Ref. No.	Name of Part and Description	Function	Mfr. and Designation	Drawing or Spec. No.
FU1	3Z1921A	FUSE: Cartridge type; 10 amperes, 25 volts.		Littel fuse #3AG-1081C	A11302-28
J1	2ZK5531.10	JACK: 1-circuit; standard type.	Headset plug receptacle	Carter #XG-315	A28960 A26837
J3	2Z7126.1	RECEPTACLE: Wall mounting type; SK-C16-32S; 16 contact.	Receptacle for plug P3	Cannon type SK-C16-32S	A30089
LM-1	2Z5932	LAMP: 3 volts, 0.19 ampere.	Dial light	Pioneer Inst.	A18881-1
R2, R3	2Z7284.15	POTENTIOMETER: Two potentiometers welded back-to-back; R3 mounted on panel and supports R2.		I.R.C.	A14551
R2		POTENTIOMETER: 2,000 ohms ±10%; taper D; screw-driver slot shaft.	Threshhold sensitivity control		
R3		POTENTIOMETER: 50,000 ohms ±10%; taper C.	"COMPASS" control		
R6	2Z7266-1	RHEOSTAT: 100 ohms; wire wound; taper A.	"LIGHT" control	I.R.C.	A14549
R35-3	3Z6011G7	RESISTOR: 2-section; total 117 ohms; section A—50 ohms; section B—67 ohms; wire wound; metal case.	Panel light voltage	I.R.C. type MW2	A14739
S8	3ZK9285-62.50	SWITCH: Rotary; 4-pole, 4 throw and SPST snap switch "off" in 1st positions "on" in all other positions.	Function selector	Oak type H	A14657
S10	3Z9692-2	SWITCH: Toggle; SPST.	CW "ON-OFF" switch	H & H	A26947-1

MODEL: MN-26* RADIO COMPASS EQUIPMENT PART II-A MAJOR UNIT: TYPE MN-28A, C, NA, and Y REMOTE CONTROL

Reference Symbol	Army Stock No. Navy Type No. British Ref. No.	Name of Part and Description	Function	Mfr. and Designation	Drawing or Spec. No.
R4A	2ZK7284-38	POTENTIOMETER: Dual; front section (R4A) 2000 ohms ±10%; rear section (R4B) 25,000 ohms ±30%.	TEL. output control	Allen-Bradley type JJ Bradley-ometer	L72704
R4B		See R4A.	R-F gain control		
R42		RESISTOR: Fixed; 250 ohms ±10%, ½ watt.	Audio dropping	Erie	A18150-251
S9		SWITCH: Rotary; 1-pole, 3 throw; amperes; 250 volts.	Band selector	Oak type H	A100798
		PART II-B	MAJOR UNIT: TYPE MN-28G REMOTE CONTROL		
R4A		POTENTIOMETER: Dual; front section (R4A) 25,000 ohms; rear section (R4B) 25,000 ohms.	TEL. output control	Allen-Bradley type JJ Bradley-ometer	A14550
R4B		See R4A.	R-F gain control		
S9		SWITCH: Rotary; 1 pole, 3 throw; 3 amperes, 250 volts.	Band selector	Oak type H	A26947-1
		PART II-C	MAJOR UNIT: TYPE MN-28X REMOTE CONTROL		
R4A		POTENTIOMETER: Dual; front section (R4A) 2,000 ohms ±10%; rear section (R4B) 25,000 ohms, ±30%.	TEL. output control	Allen-Bradley type JJ Bradley-ometer	L72704
R4B		See R4A.	R-F gain control		
S9		SWITCH: Rotary; 1-pole, 3 throw; 3 amperes, 250 volts.	Band selector	Oak type H	A100798

ITEM	EQUIPMENT	NO REQ'D	BENDIX NO.	DRAWING-SPEC
1	RADIO COMPASS	1	MN-26 C	
2	REMOTE CONTROL	1	MN-28 C MN-28 G	SEE NOTE 6
3	LEFT-RIGHT INDICATOR	1 OR 2	IN-4A	
4	AZIMUTH CONTROL	1	MN-52 G	SEE NOTE 8
5	CONNECTOR PANEL			
6	PLUG	1	A30095	CANNON NK-C23-21-5/8 B
7	PLUG	1	A30090	CANNON SK-C16-21-1/2 B
8	PLUG	1	A30088	CANNON WK-6-21-3/8 B
9	PLUG	1	87380-2	
10	PLUG (LOOP CABLE)		A30085	
11	LOOP	1	MN-24A MN-20A OR C	SEE NOTE 7
12	LOOP CABLE	AS REQ'D.	AC55966-1	SEE NOTE 5
	TUNING SHAFT	AS REQ'D.	AA15410-1	
	WARNING LIGHT ASSEM.		A30065	
	METER LOAD ASSEM.		AA18824-1	SEE NOTE 1
13	PLUG AN-3106-8S-15	1		AN-W-C-591
14	ADAPTER AN-3057-3	1		AN-3057



9 MN-26Y AIRCRAFT RADIO COMPASS EQUIPMENT IS SIMILAR TO MN-26C. IT IS DESIGNED FOR USE WITH A 28 V.D.C. POWER SUPPLY AND IS NORMALLY WIRED FOR 600 OHMS IMPEDANCE OUTPUT. FREQUENCY RANGE IS 150-325, 325-695, AND 3400-7000 KCS. COMPASS OPERATION ON BANDS I & II ONLY.

8 THE MN-52G REMOTE CONTROL WILL SUPERSEDE THE MN-52A AND HAS ONLY A SINGLE CONTACT SOCKET INSTEAD OF THE 6 CONTACTS AND WILL USE A TYPE AN-3106-8S-15 PLUG WITH CABLE ADAPTER AN-3057-3. THE MN-52H TYPE SIMILAR TO MN-52A BUT USING SINGLE CONTACT PLUG WILL BE USED UNTIL THE MN-52G TYPES ARE AVAILABLE.

7 MN-20A LOOP IS OF 9" DIAMETER, AND MN-24A LOOP IS OF 18" DIAMETER. EACH WITH RT. ANGLE FITTING MN-20C, MN-20E WITH STRAIGHT (180°) FITTING, 9" DIAMETER.

6 REMOTE CONTROL UNIT MN-28C IS FOR 600 OHM. OUTPUT AND MN-28G FOR 4000 OHMS OUTPUT. MN-28Y FOR MN-26Y COMPASS.

5 THE AC-55966-1 LOOP TRANSMISSION CABLE IS A SHIELDED 3 CONDUCTOR CABLE COMPLETELY ASSEMBLED TO ONE 90° AND ONE STRAIGHT CORD PLUG, STANDARD LENGTHS OF 72", 112", & 168". CABLE SHOULD BE TAPED WHERE IT COMES IN CONTACT WITH METAL. ITEM 12 INCLUDES ITEMS 8 AND 10

4 WHEN NO TUNING METER IS USED THIS TERMINAL MUST BE CONNECTED TO GROUND.

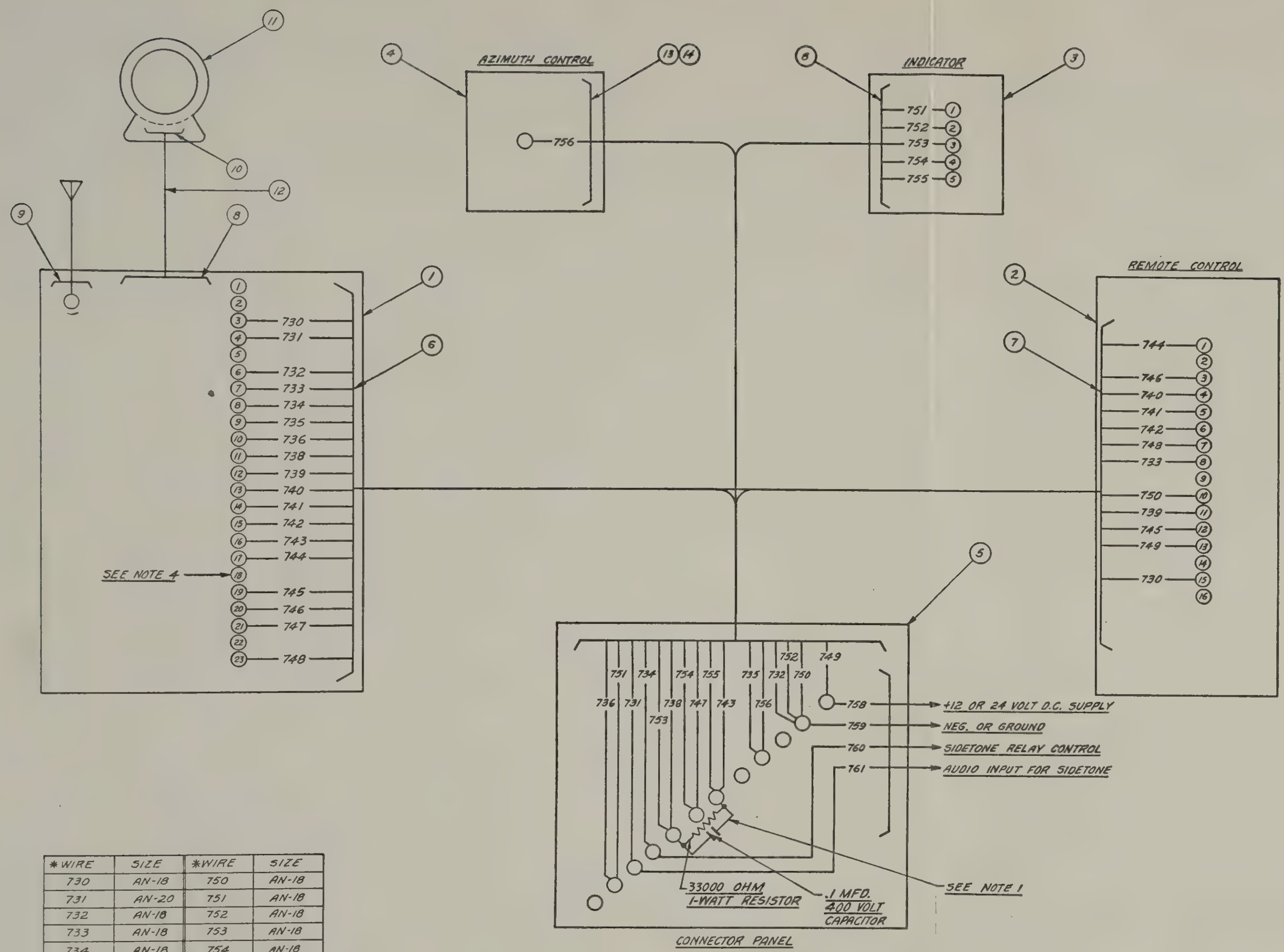
3 FOR 14 OR 28 VOLT OPERATION FOLLOW INSTRUCTIONS CAREFULLY AS GIVEN ON FIG. 9 OF INSTRUCTION BOOK DATED OCT., 1941 OR LATER.

2 REMOVE JUMPER IN MN-26( ) RECEIVER BETWEEN R-37-2 AND R-35-1 AS MARKED BY AN ASTERISK NOTE ON FIG. 9 IN INSTRUCTION BOOK DATED OCT., 1941 OR LATER, IF SIDETONE RELAY TER. 5 OF PLUG A30095 IS USED WITH ASSOCIATED EQUIPMENT.

1 ASSEMBLY NO. AA18824-1 TO BE CONNECTED WHERE ONE INDICATOR IN-4A IS USED. THIS BENDIX ASSEMBLY IS THE EQUIVALENT OF THE RESISTOR AND CAPACITOR AS SHOWN.

Figure 49—Typical Interconnecting Cable Diagram

ITEM	EQUIPMENT	NO REQ'D	BENDIX NO.	DRAWING·SPEC
1	RADIO COMPASS	1	MN-26C	
2	REMOTE CONTROL	1	MN-28C MN-28G	SEE NOTE 6
3	LEFT-RIGHT INDICATOR	1 OR 2	IN-4A	
4	AZIMUTH CONTROL	1	MN-52G	SEE NOTE 8
5	CONNECTOR PANEL			
6	PLUG	1	A30095	CANNON NK-C23-21-3/8B
7	PLUG	1	A30090	CANNON SK-C16-21-1/2B
8	PLUG	1	A30088	CANNON WK-6-21-3/8B
9	PLUG	1	B7380-2	
10	PLUG (LOOP CABLE)		A30085	
11	LOOP	1	MN-24A MN-20A OR C	SEE NOTE 7
12	LOOP CABLE	AS REQ'D.	AC55966-1	SEE NOTE 5
	TUNING SHAFT	AS REQ'D.	AA15410-1	
	WARNING LIGHT ASSEM.		A30065	
	METER LOAD ASSEM.		AA18824-1	SEE NOTE 1
13	PLUG AN-3106-8S-15	1		AN-W-C-591
14	ADAPTER AN-3057-3	1		AN-3057



*WIRE	SIZE	*WIRE	SIZE
730	AN-18	750	AN-18
731	AN-20	751	AN-18
732	AN-18	752	AN-18
733	AN-18	753	AN-18
734	AN-18	754	AN-18
735	AN-18	755	AN-18
736	AN-18	756	AN-18
738	AN-18	758	AN-18
739	AN-20	759	AN-18
740	AN-18	760	AN-18
741	AN-18	761	AN-20
742	AN-18		
743	AN-18		
744	AN-20		
745	AN-20		
746	AN-20		
747	AN-18		
748	AN-20		
749	AN-18		

ALL WIRES TO BE AIRCRAFT CABLE PER SPEC. AN-J-C-48a.

* ALL WIRE NUMBERS ARE FOR REFERENCE ON THIS CHART ONLY.

POWER REQUIREMENTS 28 VOLTS 3.0 AMPS.
BAND SWITCH MOTOR 1 AMPERE ADDITIONAL.
WEIGHT OF COMPONENTS APP. - 55 LBS.

FREQUENCY RANGE	150-325 325-695 695-1500	150-325 325-695 3400-7000	200-410 550-1200 2900-6000	200-410 410-850 3400-7000	200-410 410-850 850-1750
14 VOLT	MN-26A COMPASS	———	———	———	MN-26W
28 VOLT	MN-26C	MN-26Y	———	MN-26M	MN-26X
REMOTE CONTROL LOW-IMP.	MN-28C	MN-28Y	———	MN-28M	MN-28X
REMOTE CONTROL HIGH-IMP.	———	———	MN-28W	———	———

MN-28C, MN28NA, MN-28Y REMOTE CONTROLS HAVE 250 OHM AUDIO SERIES RESISTOR TO PIN #2.

MN-26 COMPASSES MAY BE WIRED FOR EITHER LOW OR HIGH IMPEDANCE AUDIO OUTPUT.
* INDICATES AUTOMATIC RADIO COMPASSES.

9 MN-26Y AIRCRAFT RADIO COMPASS EQUIPMENT IS SIMILAR TO MN-26C. IT IS DESIGNED FOR USE WITH A 28 V.D.C. POWER SUPPLY AND IS NORMALLY WIRED FOR 600 OHMS IMPEDANCE OUTPUT. FREQUENCY RANGE IS 150-325, 325-695, AND 3400-7000 KCS. COMPASS OPERATION ON BANDS I & II ONLY.

8 THE MN-52G REMOTE CONTROL WILL SUPERSEDE THE MN-52A AND HAS ONLY A SINGLE CONTACT SOCKET INSTEAD OF THE 6 CONTACTS AND WILL USE A TYPE AN-3106-8S-15 PLUG WITH CABLE ADAPTER AN-3057-3 THE MN-52H TYPE SIMILAR TO MN-52A BUT USING SINGLE CONTACT PLUG WILL BE USED UNTIL THE MN-52G TYPES ARE AVAILABLE.

7 MN-20A LOOP IS OF 9" DIAMETER, AND MN-24A LOOP IS OF 18" DIAMETER. EACH WITH RT. ANGLE FITTING MN-20C, MN-20E WITH STRAIGHT (180°) FITTING, 9" DIAMETER.

6 REMOTE CONTROL UNIT MN-28C IS FOR 600 OHM. OUTPUT AND MN-28G FOR 4000 OHMS OUTPUT. MN-28Y FOR MN-26Y COMPASS.

5 THE AC-55966-1 LOOP TRANSMISSION CABLE IS A SHIELDED 3 CONDUCTOR CABLE COMPLETELY ASSEMBLED TO ONE 90° AND ONE STRAIGHT CORD PLUG, STANDARD LENGTHS OF 72", 112", & 168". CABLE SHOULD BE TAPED WHERE IT COMES IN CONTACT WITH METAL. ITEM 12 INCLUDES ITEMS 8 AND 10

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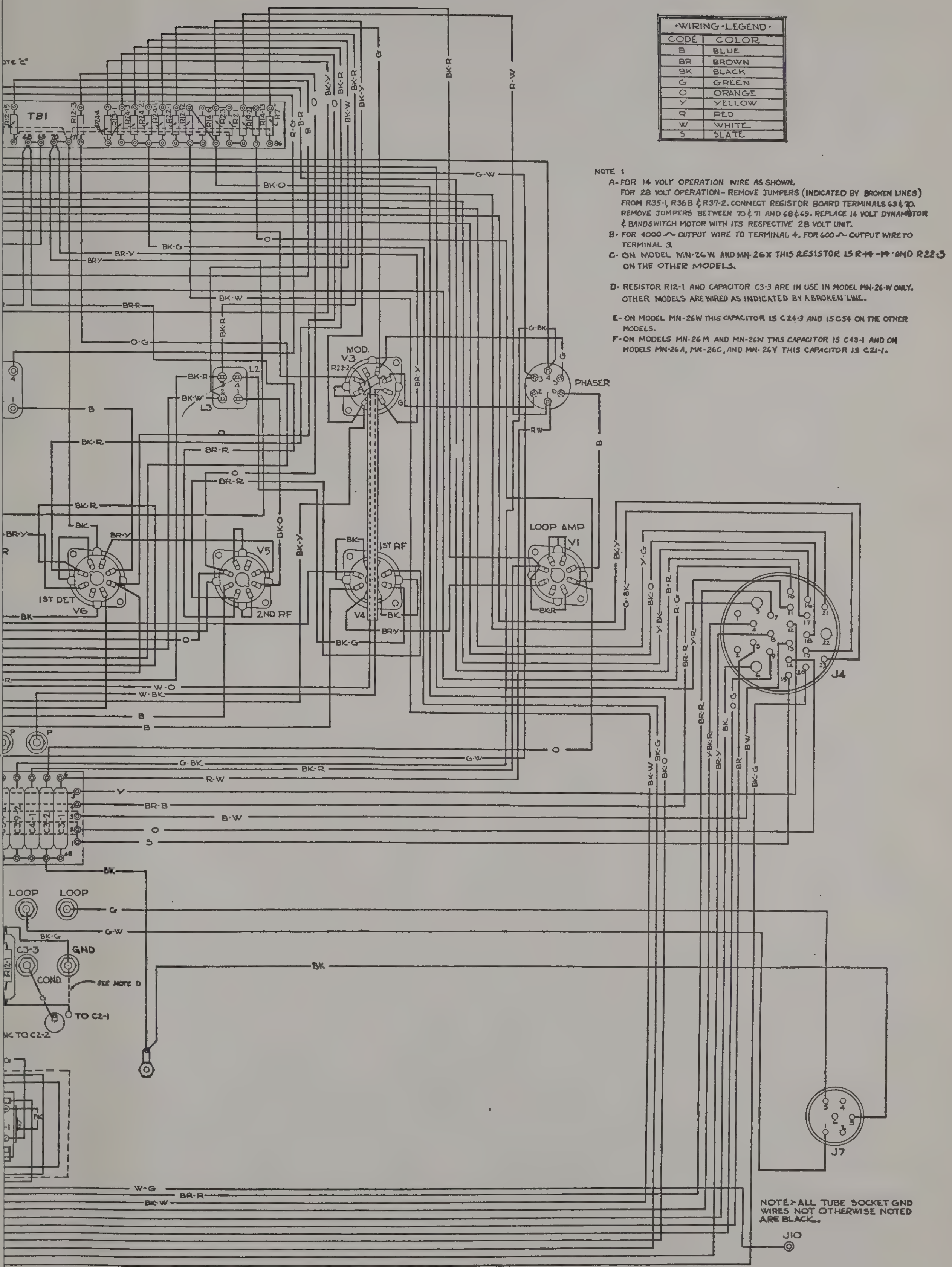
1 ASSEMBLY NO. AA18824-1 TO BE CONNECTED WHERE ONE INDICATOR IN-4A IS USED. THIS BENDIX ASSEMBLY IS THE EQUIVALENT OF THE RESISTOR AND CAPACITOR AS SHOWN.

Figure 49—Typical Interconnecting Cable Diagram



·WIRING·LEGEND·

CODE	COLOR
B	BLUE
BR	BROWN
BK	BLACK
G	GREEN
O	ORANGE
Y	YELLOW
R	RED
W	WHITE
S	SLATE

NOTE :

A- FOR 14 VOLT OPERATION WIRE AS SHOWN.
FOR 28 VOLT OPERATION - REMOVE JUMPERS (INDICATED BY BROKEN LINES) FROM R35-1, R36B & R37-2. CONNECT REGISTOR BOARD TERMINALS 69 & 70. REMOVE JUMPERS BETWEEN 70 & 71 AND 68 & 69. REPLACE 14 VOLT DYNAMOTOR & BANDSWITCH MOTOR WITH ITS RESPECTIVE 28 VOLT UNIT.

B- FOR 4000~ OUTPUT WIRE TO TERMINAL 4. FOR 600~ OUTPUT WIRE TO TERMINAL 3.

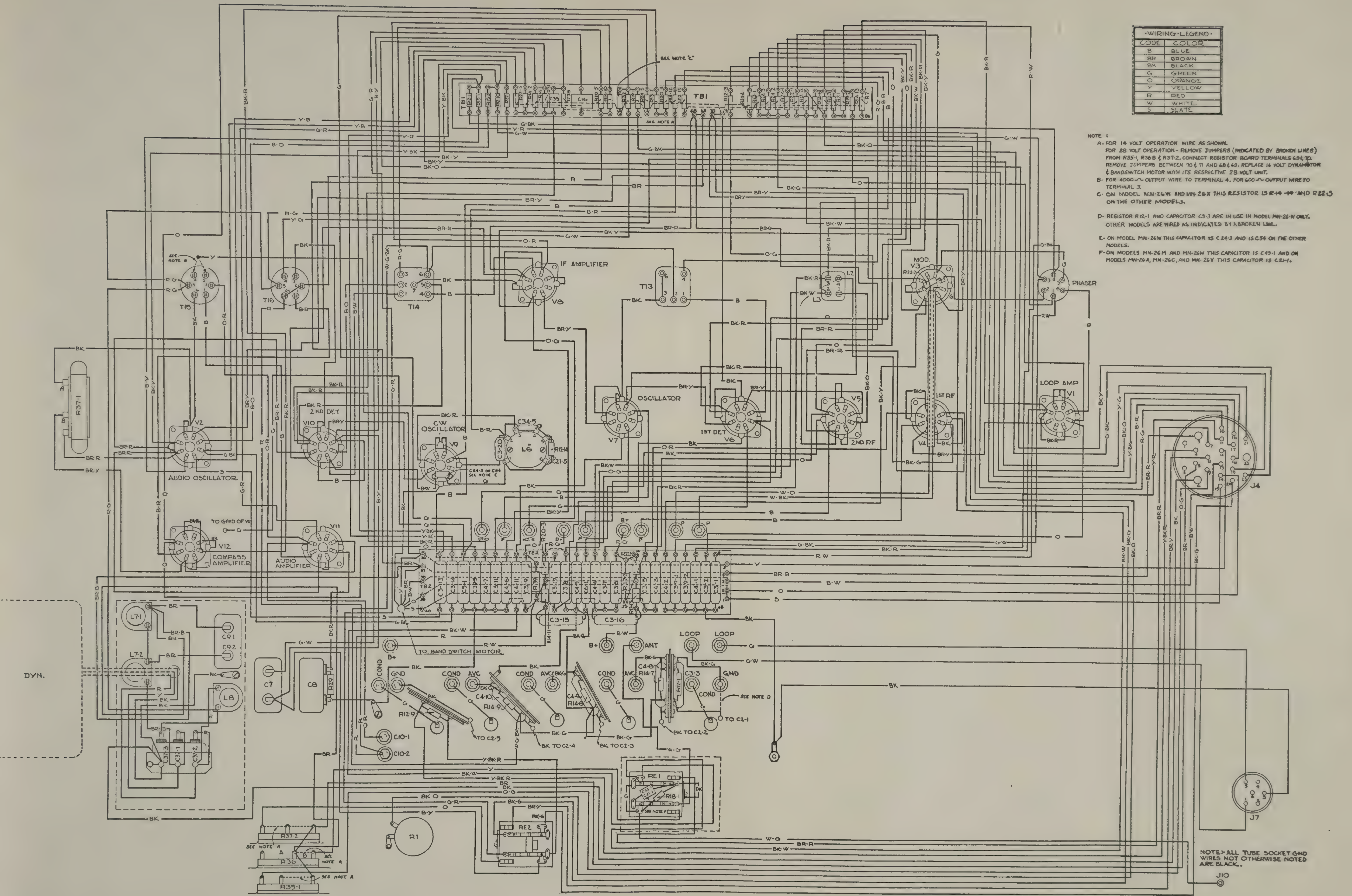
C- ON MODEL MN-26W AND MN-26X THIS RESISTOR IS R14-14 AND R22-3 ON THE OTHER MODELS.

D- RESISTOR R12-1 AND CAPACITOR C3-3 ARE IN USE IN MODEL MN-26-W ONLY. OTHER MODELS ARE WIRED AS INDICATED BY A BROKEN LINE.

E- ON MODEL MN-26W THIS CAPACITOR IS C24-3 AND IS C54 ON THE OTHER MODELS.

F- ON MODELS MN-26M AND MN-26W THIS CAPACITOR IS C43-1 AND ON MODELS MN-26A, MN-26C, AND MN-26Y THIS CAPACITOR IS C21-1.

Figure 50—Type MN-26 Radio Compass, Wiring Diagram*



·WIRING·LEGEND·	
CODE	COLOR
B	BLUE
BR	BROWN
BK	BLACK
G	GREEN
O	ORANGE
Y	YELLOW
R	RED
W	WHITE
S	SLATE

NOTE :

A- FOR 14 VOLT OPERATION WIRE AS SHOWN.
FOR 28 VOLT OPERATION - REMOVE JUMPERS (INDICATED BY BROKEN LINES) FROM R35-1, R36 B & R37-2. CONNECT RESISTOR BOARD TERMINALS 69 & 70. REMOVE JUMPERS BETWEEN 70 & 71 AND 68 & 69. REPLACE 14 VOLT DYNAMOTOR & BANDSWITCH MOTOR WITH ITS RESPECTIVE 28 VOLT UNIT.

B- FOR 4000 ~ OUTPUT WIRE TO TERMINAL 4. FOR 600 ~ OUTPUT WIRE TO TERMINAL 3.

C- ON MODEL MN-26W AND MN-26X THIS RESISTOR IS R14-14 AND R22-3 ON THE OTHER MODELS.

D- RESISTOR R12-1 AND CAPACITOR C3-3 ARE IN USE IN MODEL MN-26-W ONLY. OTHER MODELS ARE WIRED AS INDICATED BY A BROKEN LINE.

E- ON MODEL MN-26W THIS CAPACITOR IS C24-3 AND IS C54 ON THE OTHER MODELS.

F- ON MODELS MN-26M AND MN-26W THIS CAPACITOR IS C43-1 AND ON MODELS MN-26A, MN-26C, AND MN-26Y THIS CAPACITOR IS C21-1.

Figure 50—Type MN-26 Radio Compass, Wiring Diagram*

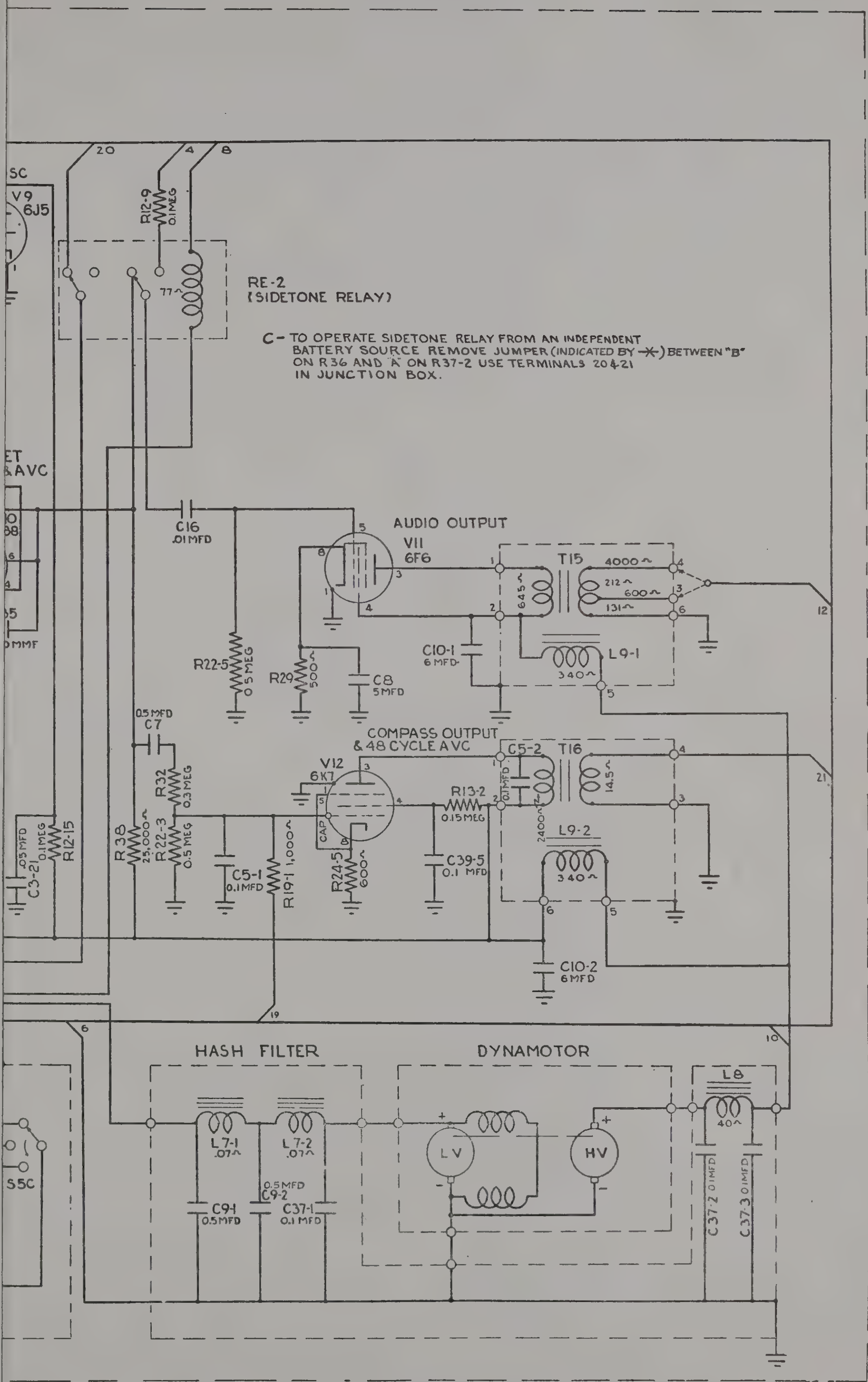


Figure 51—Types MN-26A, MN-26C, and MN-26CA Radio Compass, Schematic Circuit Diagram

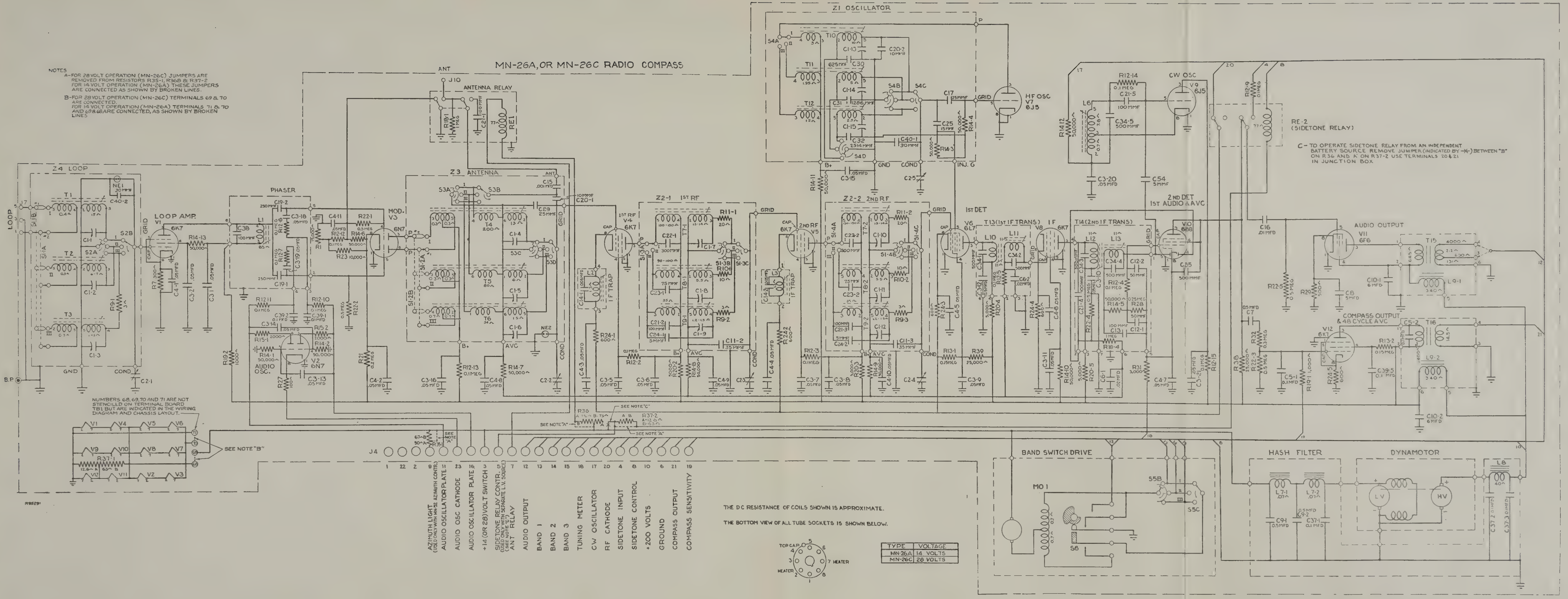


Figure 51—Types MN-26A, MN-26C, and MN-26CA Radio Compass, Schematic Circuit Diagram

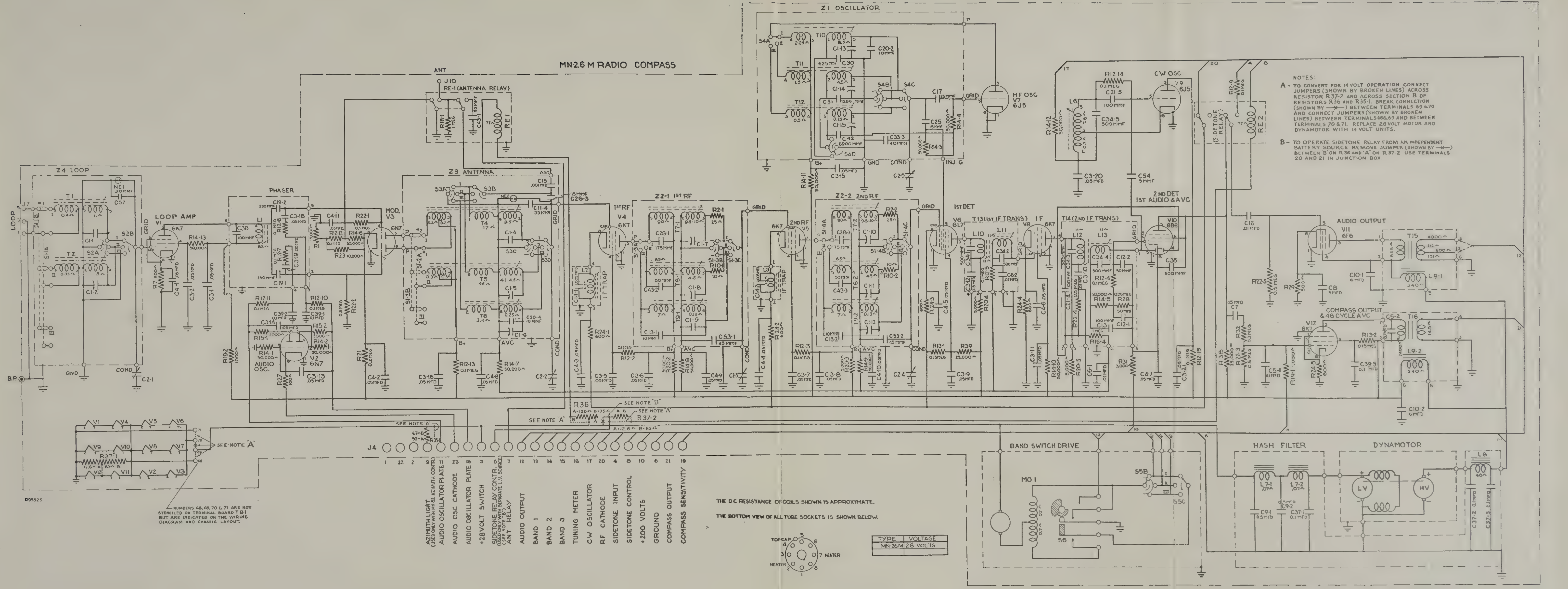


Figure 52—Type MN-26M Radio Compass, Schematic Circuit Diagram

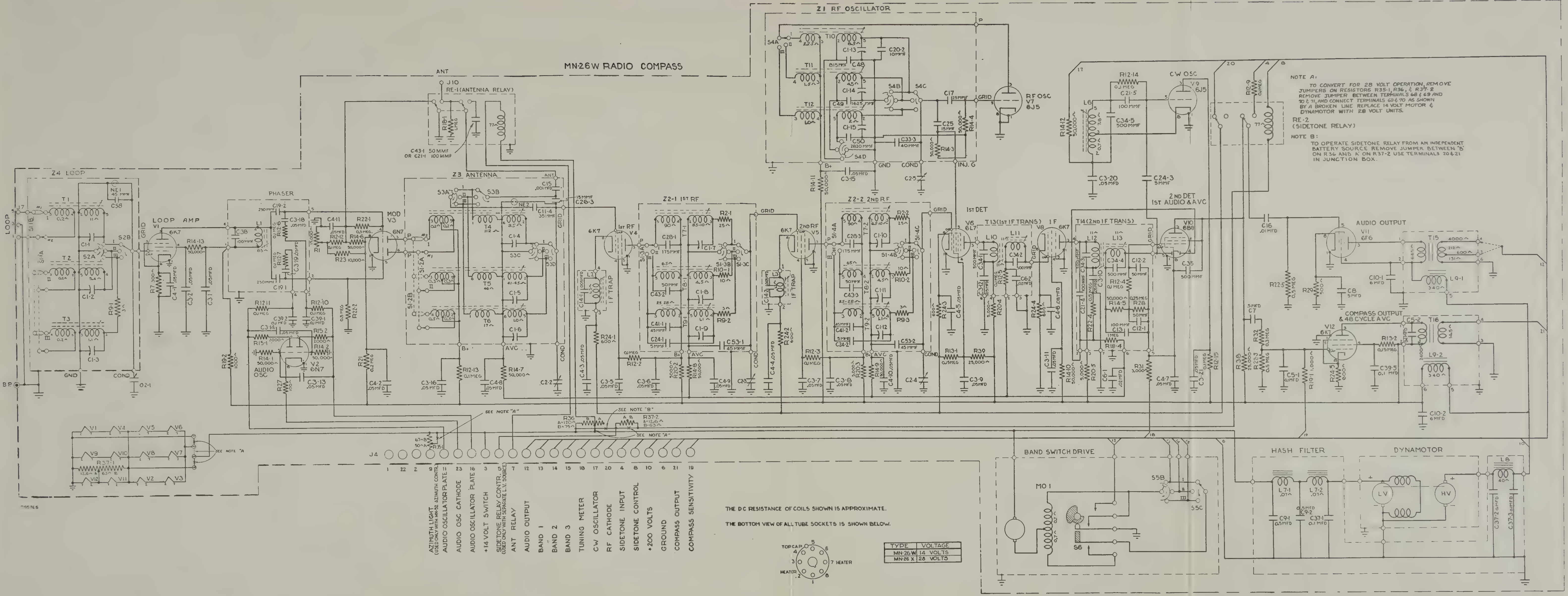


Figure 53—Types MN-26W and MN-26X Radio Compass, Schematic Circuit Diagram

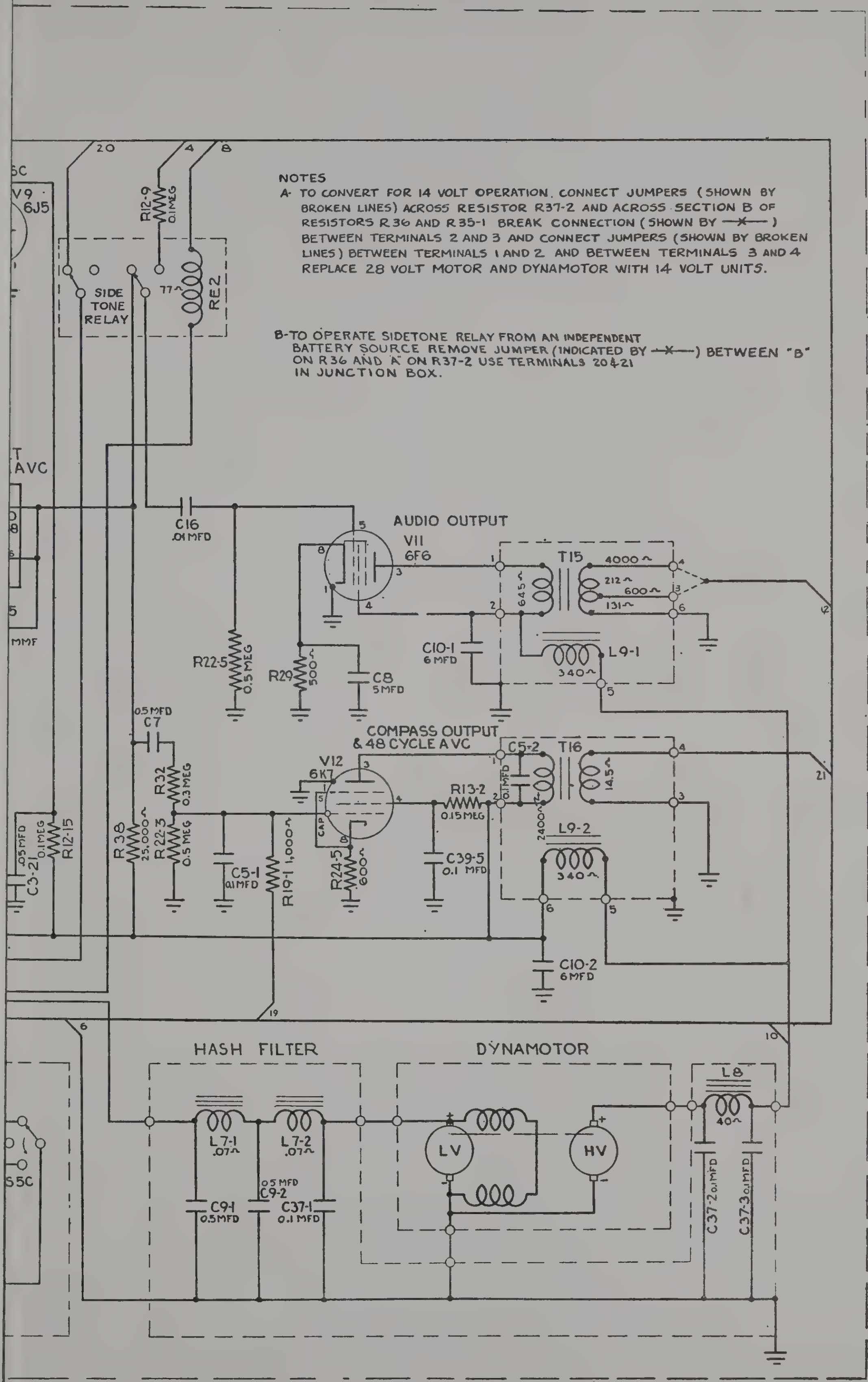


Figure 54—Type MN-26Y Radio Compass, Schematic Circuit Diagram

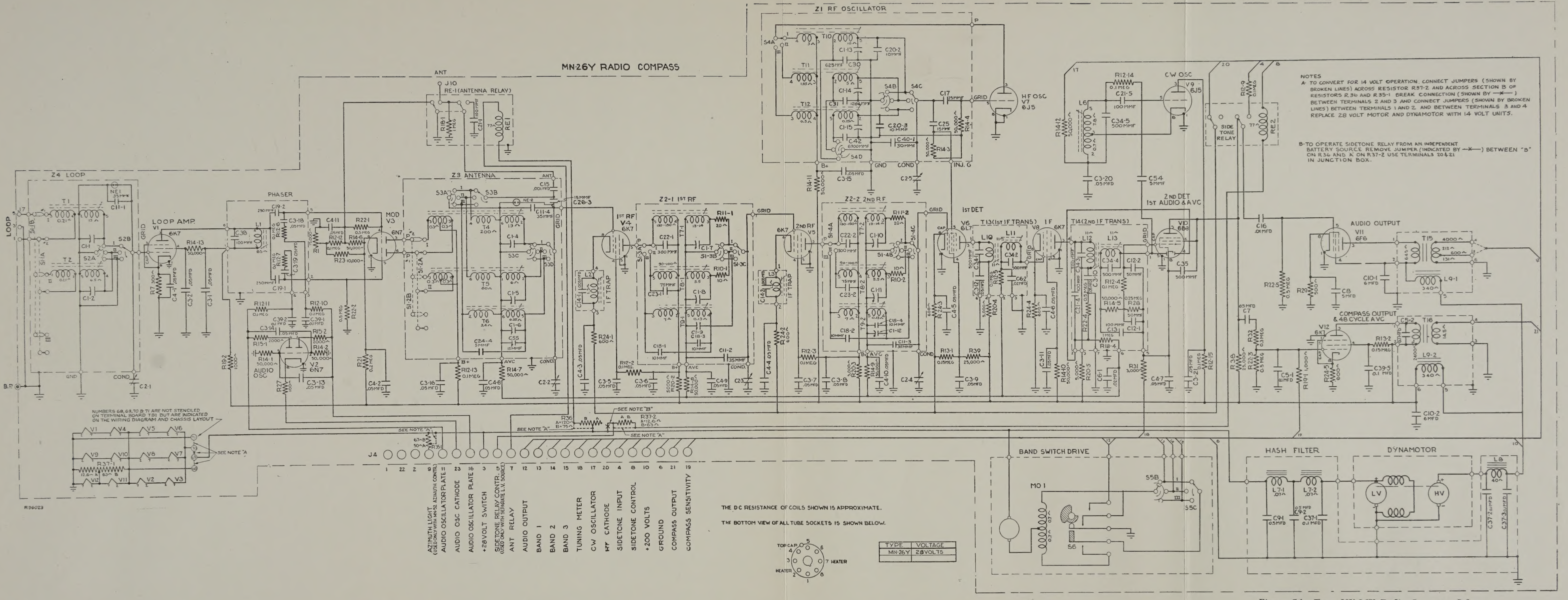


Figure 54—Type MN-26Y Radio Compass, Schematic Circuit Diagram

STATION USED ______________ FREQ. ______________

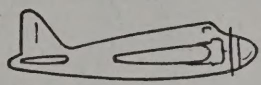
PLANE NO. ______________ PILOT ______________

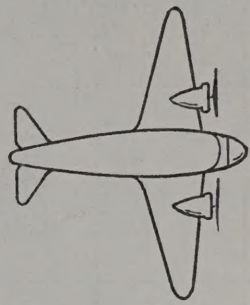
RECORDER ______________ DATE ______________

REF. MARK QUAD. POSITION 0° ____ 90° ____ 180° ____ 270° ____

LOCATION ______________

SKETCH LOOP AND ANTENNA POSITIONS





GYRO HEADING	PLANE TO RADIO STATION BEARING (TRUE RADIO BEARING)	OBSERVED RADIO BEARING (INDICATED ON MN-22A)	BEARING CORRECTION (COLUMN 2 MINUS COLUMN 3)
COLUMN 1	COLUMN 2	COLUMN 3	COLUMN 4
0	0		
15	345		
345	15		
30	330		
330	30		
180	180		
195	165		
165	195		
210	150		
150	210		
0	0		
45	315		
315	45		
60	300		
300	60		
180	180		
225	135		
135	225		
240	120		
120	240		
0	0		
75	285		
285	75		
90	270		
270	90		
180	180		
255	105		
105	255		
180	180		

CAM SCALE (OF MN-22A)	CAM CORRECTION FOR MN-22A (FROM CURVE)	
COLUMN 5	COLUMN 6	
0		
15		
345		
30		
330		
45		
315		
60		
300		
75		
285		
90		
270		
105		
255		
120		
240		
135		
225		
150		
210		
165		
195		
180		

Figure 55—Quadrantal Error Data Sheet

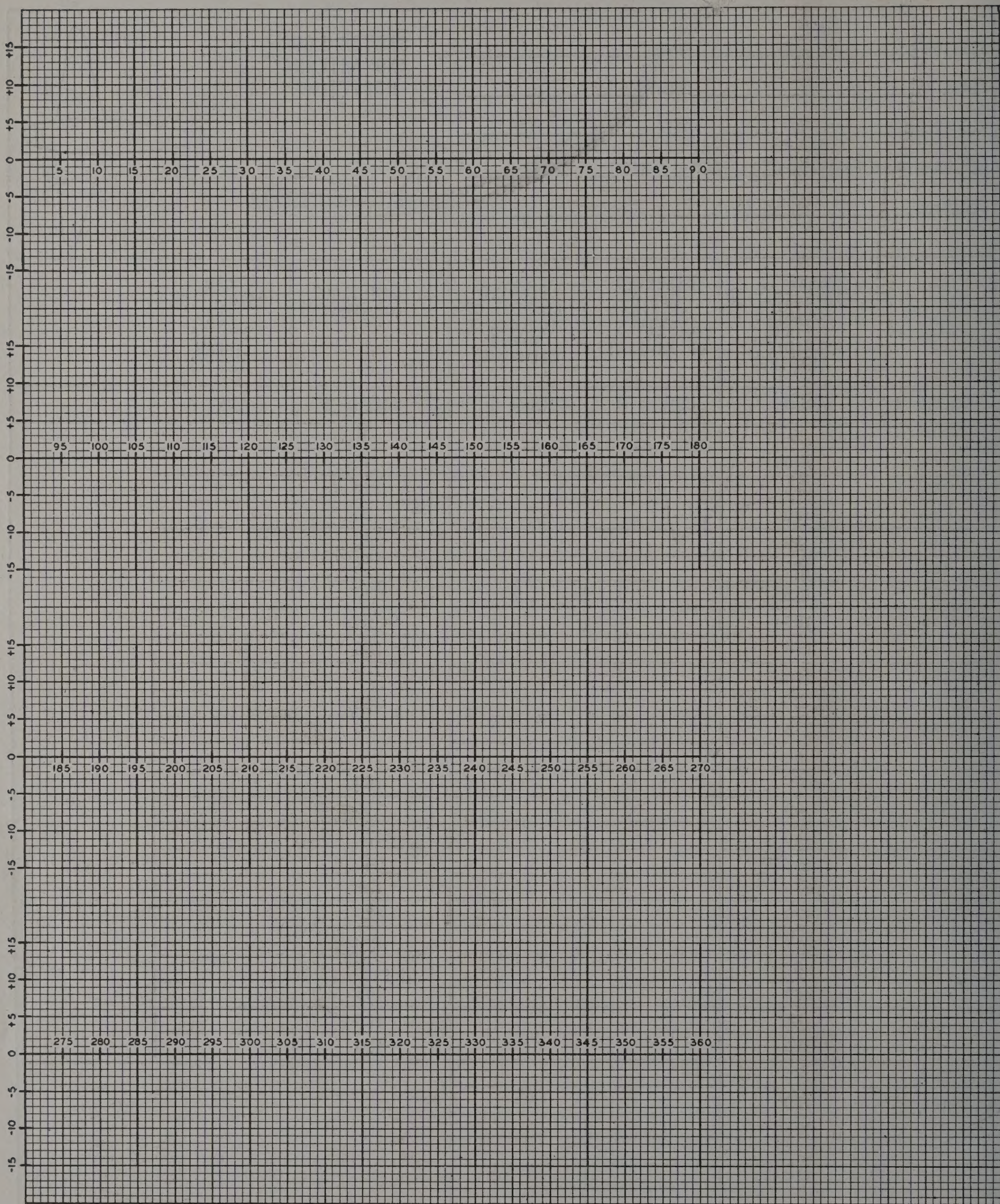


Figure 56—Quadrantal Error Calibration Curve